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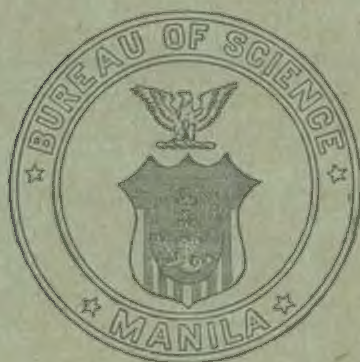
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- <sup>31</sup>No. 31, 1905, *Biological Laboratory*.—I. Notes on a Case of Hematochyliuria (Together with Some Observations on the Morphology of the Embryo Neumata, *Filaria Nocturna*). By William B. Wherry, M. D., and John R. McDill, M. D., Manila, P. I. II. A Search into the Nitrate and Nitrite Content of Witte's "Peptone," with Special Reference to Its Influence on the Demonstration of the Indol and Cholera-Red Reactions. By William B. Wherry, M. D.

<sup>1</sup>Out of print.

<sup>2</sup>The first four bulletins in the ornithological series were published by the Ethnological Survey under the title "Bulletins of the Philippine Museum." Later ornithological publications of the Government appeared as publications of the Bureau of Government Laboratories.

Harry M. Jenkins, E. M.

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# THE PHILIPPINE JOURNAL OF SCIENCE

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THE PREVALANCE AND DISTRIBUTION OF THE ANIMAL PARASITES OF MAN IN THE PHILIPPINE ISLANDS, WITH A CONSIDERATION OF THEIR POSSIBLE INFLUENCE UPON THE PUBLIC HEALTH.<sup>1</sup>

By PHILIP E. GARRISON.<sup>2</sup>

(From the Biological Laboratory, Bureau of Science, Manila, P. I.)

## Summary of results.

Examinations and infections.	Num-ber.	Per cent.	Examinations and infections.	Num-ber.	Per cent.
Prisoners examined .....	4,106	---	"Japanese lung flukes" ( <i>Paragonimus</i> ) .....	18	0.4
Prisoners infected .....	3,447	84	"Japanese blood flukes" ( <i>Schistosoma</i> ) .....	10	0.4
Whipworms ( <i>Trichuris</i> ) .....	2,426	59	"Japanese liver flukes" ( <i>Opisthorchis</i> ) .....	11	0.3
Hookworms .....	2,185	52	The "dwarf tapeworm" ( <i>Hymenolepis</i> ) .....	5	0.1
Belworms ( <i>Arcaris</i> ) .....	1,052	26	Total infections .....	7,636	186
<i>Amoeba</i> .....	926	23	Intestinal worms only .....	5,812	142
Other intestinal protozoa (ciliates and flagellates) .....	853	21	Flukes .....	45	1.1
"Cochin-China diarrhoea worms" ( <i>Strongyloides</i> ) .....	132	3	All intestinal protozoa .....	1,779	43
Pinworms ( <i>Oxyuris</i> ) .....	32	0.8			
<i>Tenia</i> .....	30	0.7			

<sup>1</sup> Read at the Fifth Annual Meeting of the Philippine Islands Medical Association, Manila, February 27, 1908.

<sup>2</sup> Assistant surgeon, United States Navy; detailed medical zoölogist to Biological Laboratory the Bureau of Science, Manila, P. I.

## INTRODUCTION.

The present paper reports the results of a statistical investigation concerning the prevalence of animal parasites among the Filipinos, conducted through the year 1907, for the purpose of obtaining accurate knowledge which would serve as a guide to some definite conclusions with regard to the importance of animal parasites and more especially of intestinal worms in the Philippines, and of their possible influence as a factor in determining the hygienic and industrial status of the Filipino people.

In examining the faeces for these infections, diagnoses were made not only of protozoal and verminous infections of the intestine, but of infections in other organs with worms the ova of which escaped by means of the intestinal tract. Therefore, the investigation was made upon those animal parasites the infection with which could be diagnosed by examination of the faeces and included in addition to parasites of the intestine, certain forms living in the liver (*Opisthorchis*, *Fasciola*, etc.), the lungs (*Paragonimus*), and in the veins or arteries of the lower part of the intestinal tract (*Schistosoma*). Accordingly, while the expression "intestinal parasites" would include most of the species considered, the presence of infections with forms not of the intestine, which it was highly desirable to retain in our statistics, made it necessary to employ in the title the broad term of "animal parasites" and to limit its scope as has been indicated.

## MATERIAL.

A most favorable field for the investigation presented itself at Bilibid Prison where a changing population of about 3,500 prisoners from all parts of the Islands was available for examination and where the routine microscopic examination of faeces was already established.

The great majority of the prisoners were adult male Filipinos, but some native women, a number of Chinese, and a few Americans were among the cases examined.

Almost all of the population of the prison was examined during the year, the entire work including a total of 4,106 persons. Prisoners newly admitted were subjected to examination at once in quarantine, while the others were placed in a special ward until specimens of faeces could be obtained and studied. In addition, examination was made of the stools of all prisoners admitted to the prison hospital for other causes.

Specimens were taken from fresh stools obtained after the subject had been given a dose of magnesium sulphate. The necessary number of daily examinations made it impossible to study more than one cover-glass preparation from each specimen and if no infection was detected

the individual was dismissed without further examination. Cases requiring treatment were kept in the hospital and antihelminthics were administered repeatedly until two examinations for *Ascaris* or three for hookworms proved negative. The inadequacy of an examination based on a single cover-glass preparation was fully recognized, and was repeatedly proved by instances in which the first examination showed only one infection while subsequent ones revealed several. It is to be assumed that since many individuals gave negative results at first and were not again examined, many infections escaped diagnosis and that the figures given are below the number of infections actually present in the 4,106 prisoners.

A selection of cases presents itself because the prisoners were all adults and nearly all males. The results of the work of a number of authors, publishing in the aggregate upon about 10,000 cases, have shown fairly conclusively that with the exception of a few species, the percentage of infection with animal parasites is higher in children than in adults, and in females than in males. Hence it would appear in this connection also that the figures presented by the Bilibid prisoners are a minimum if taken as an index of infection in the population as a whole.

Aside from the question of sex and age, it is probable that the prisoners at Bilibid are fairly representative of the general population, coming as they do from the various provinces scattered throughout the Islands and from all classes of society, although the lower laboring class may have been present somewhat in excess of the proportion which it holds in the mass of the people.

The institution of this investigation and the recording and compilation of the data obtained for this study were entirely the work of the author. About 7,000 of the 15,000 examinations entering into this work were made by Dr. Ralph T. Edwards, who was in charge of the Bureau of Science routine work in clinical microscopy at Bilibid. Frequently prisoners were examined and treated by Dr. E. C. Shattuck,<sup>3</sup> resident physician at Bilibid, before the examination by the Bureau of Science was made, and in order that our record of infections for each patient might be complete, Dr. Shattuck has kindly allowed me to use the results

<sup>3</sup> Shattuck, *Amer. Med.* (1907) 13, reporting upon uncinariasis in Bilibid Prison, particularly with regard to its diagnosis and treatment, states that as the result of approximately 1,000 examinations he found 243 cases of uncinariasis, 63 of amebic dysentery, 3 of *Balantidium coli* infection, 186 of ascariasis and 7 of teniasis. Shattuck's work was done from a clinical rather than statistical viewpoint, and he has kindly given us his cooperation in our effort to establish the actual frequency with which infection with animal parasites prevails among the Filipinos.



of about 5,000 examinations which he made upon these 4,106 prisoners either before or after their examination by Dr. Edwards or myself.

Since the work of accurately determining the specific identity of the parasites found is still in progress; since in many cases it is impossible to make more than a generic diagnosis from the ova alone and since further, the medical and sanitary interests involved are, with few exceptions, identical for different species of the same genus, we shall use only generic names throughout the present paper.

In addition to the microscopic findings, a record was kept of the province from which each prisoner came, with the object of discovering any inequalities in the geographical distribution of infections which might be of practical value with regard to the establishment of sanitary procedures in the Islands.

#### GENERAL RESULTS.

Of the 4,106 prisoners examined, 3,447 were found to be infected with one or more species of animal parasite,\* an average of 84 per cent. The total number of infections was 7,636, an average of 186 infections for each 100 prisoners examined.

Unfortunately we know of no statistics for tropical countries, based upon an adequate number of examinations, which are suitable for close comparison with these figures for the number of infected persons. The Anæmia Commission of Porto Rico reported 100 per cent of the persons which were examined to be infected with hookworms, their work being directed purposely to that parasite and their report not being upon a true statistical basis for the general population. Dobson and Fearnside, in India, give the number of infections found, but fail to state the number of persons infected. Calvert, in India, found 92 per cent infected, but examined only 100 men.\*

The total number of infections reported by these authors is as follows:

Authority.	Date.	Country.	Number examined.	Number of infections.	Per cent.
Anæmia Commission	1904	Porto Rico	4,482	6,259	139.64
Calvert	1901	India	100	143	143
Fearnside	1900	do	878	921	104.90
Dobson	1893	do	1,249	1,340	107.28

\* For complete bibliographical references to authorities quoted in the present paper see Stiles & Garrison; *A Statistical Study of the Prevalence of Intestinal Worms in Man: Bull. Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash. (1908), 28, 74-77.*

As might be expected, the figures for temperate climates are not so high. However, the following authors have reported an average of over 50 infections for each 100 persons examined:

Authority.	Date.	Country or place.	Number examined.	Number of infections.	Per cent.
Cima .....	1893, 1896	Italy .....	*110	87	79.08
Gubareff .....	1896	Russia .....	486	371	76.32
Gribbohm .....	1872-1877	Kiel, Germany .....	†972	717	73.81
Heller .....	1872-1876	do .....	†611	437	71.52
Heisig .....	1893	Griefswald .....	230	140	60.85
Grusdoff .....	1892	Kostroma, Russia .....	260	143	55

\*Children.

†Autopsy examinations.

While it could not be argued, perhaps, from a comparison of statistics, that the population of the Philippines is necessarily more generally infected with animal parasites than the people of certain other localities for which figures almost as high have been published, the fact remains that the average number of infections per 100 persons (186) found in examining the 4,106 prisoners at Bilibid, is higher by over 40 than has ever been definitely reported for any other country upon a number of cases sufficiently large to be taken as a fair index to the prevalence of animal parasites in the general population.

#### PARASITES PRESENT.

The infections represented at least fifteen genera and probably about twenty species. The genera positively determined were the two hookworms, *Necator* and *Ancylostoma*; the common "round worm," *Ascaris*; the common whipworm, *Trichuris*; the common pin or seat worm *Oxyuris*; the worm of Cochin-China diarrhoea, *Strongyloides*; the cestode genera *Tania* and *Hymenolepis*; the Japanese lung fluke, *Paragonimus*; the Japanese liver fluke, *Opisthorchis*; the Japanese blood fluke, *Schistosoma*, and the four protozoal genera, *Amoeba*, *Balantidium*, *Lambia*, and *Cercomonas*; in addition, there were a number of undoubted infections in which the identity of the parasites was not even generically determined.

#### MULTIPLE INFECTIONS.

Multiple infections were numerous, as is shown by the fact that 7,636 infections were distributed among the 3,447 infected prisoners, an average of 222 infections to each 100 infected persons, or nearly 2.25 infections per infected individual.

One thousand and sixty-seven, or slightly more than one-fourth of the prisoners examined, showed infection with one species of parasite only; of these single infections, 428 were with hookworms, 384 with whipworms, and the remaining 255 with other species.



Nine hundred and thirty, or slightly less than one-fourth of the persons examined, showed a double infection, of which hookworms and *Trichuris* gave 518, or about one-half, *Ascaris* and *Trichuris* nearly one-fourth, and various combinations the remainder.

Seven hundred and twenty-three, or about 18 per cent, had triple infections, of which the most common was with *Ascaris*, hookworms and *Trichuris*; although combined infections with *Amœba*, hookworms and *Trichuris* and with hookworms, *Trichuris* and flagellates were present with almost equal frequency.

Three hundred and sixty-six prisoners, or 9 per cent, were infected with four different parasites, the most common combination being *Amœba*, flagellates, hookworms and *Trichuris*.

One hundred and thirty-one prisoners (3 per cent) gave a combined infection with 5 parasites, 80 of which were with *Amœba*, flagellates, *Ascaris*, hookworms and *Trichuris*.

A combination of six different infections in one patient occurred fifteen times; in five of these cases the parasites were *Amœba*, flagellates, *Ascaris*, hookworms, *Strongyloides* and *Trichuris*.

Two prisoners had seven separate infections, and one man was infected with nine different parasites, the combination in the last case being *Amœba*, flagellates, *Balantidium*, *Ascaris*, hookworms, *Strongyloides*, *Trichuris*, *Opisthorchis* and *Schistosoma*.

#### GEOGRAPHIC DISTRIBUTION.

A rather elaborate attempt was made to determine whether the individuals coming from any particular part of the Islands gave an excess of infection over those from other sections. To this end, a record of the previous residence of prisoners was taken and the infections found were tabulated by separate provinces, separate islands and various groups of provinces and of islands. No significant difference in the total percentage of infection could be detected. Prisoners from the extreme northerly provinces presented about the same percentage (with all parasites) as did those from the Visayas or from central or southern Luzon.

The same even geographic distribution seemed to prevail for each separate species of parasite, with the exception of infections with the three trematode genera, *Paragonimus*, *Schistosoma* and *Opisthorchis*, especially the two former, which appeared to originate almost exclusively in certain of the southern islands.

The distribution of the infections with the three trematodes mentioned will be considered more in detail under each genus.

While practically all parts of the Islands are fairly well represented at Bilibid, an investigation conducted at such long range would be able to discover none but very marked inequalities in the distribution of the parasites and it is by no means excluded that further work, done in the various provinces themselves, would indicate an excess of infection in certain parts of the Islands, which did not appear among the prisoners examined at Bilibid.

## INFECTIONS WITH TRICHURIS.

(59 per cent.)

If we confine ourselves to statistical reports based upon an adequate number of cases (several hundred), much higher percentages of infection with whipworms have been published for temperate than for tropical climates.

The highest rate of infection with *Trichuris* definitely reported was found by Heisig in Germany in 1893 (45.21 per cent); the next, by Gubareff in Russia, in 1896 (43.62 per cent). In these cases, the total percentages of infections with all intestinal worms were only 60.85 and 76.32, respectively. Boycott in 1904 reported 38.78 per cent of whipworm infections from Cornwall, England, but only 98 men were examined. Grechaninoff (1890) found this parasite in 28.41 per cent of 583 persons examined in St. Petersburg. Other German statistics for whipworms are: Sievers, Kiel, 1887, 2,629 persons examined, 19.81 per cent infected; Roth, Bale, 1877-1880, 752 persons examined, 23.67 per cent infected; Gribbohm, Kiel, 1872-1877, 972 persons examined, 32.20 per cent infected; Heller, Kiel, 1872-1875, 611 persons examined, 30.60 per cent infected; Müller, Erlangen, 1862-1873, and Dresden, 1852-1862, 1,755 and 1,939 persons examined and 11.11 and 2.57 per cent infected, respectively.

Stiles and Garrison (1906) in examining 3,457 persons in the United States found 7.72 per cent to be infected with whipworms.

Cima (1893 and 1896) in the vicinity of Naples, Italy (subtropical), found 37.27 per cent of infection in examining 110 children.

On the other hand, we have the following statistics for whipworms from populations in the tropics: Anamia Commission, 1904, Porto Rico, 4,482 persons examined, 7.27 per cent infected; Daniels, 1901, British Central Africa, 251 examined, 2.79 per cent infected; Fearnside, 1900, India, 878 examined, 6.95 per cent infected; Dobson, India, 1893, 1,249 examined, 4.40 per cent infected.

While estimates have been made regarding the frequency of whipworm infection in different populations ranging from 50 per cent (in Italy)<sup>5</sup> to 100 per cent (in Paris)<sup>6</sup> it appears that our figures for the Philippines (59 per cent) give a higher rate of infection with this parasite than has ever been definitely reported upon a number of cases sufficiently large to serve as an index to the general population.<sup>7</sup> This fact would seem to give fairly conclusive proof to the view that the relatively low rates of

<sup>5</sup> Blanchard, Raphael: *Traité De Zoologie Medicale*. Paris (1889), 1, 735.

<sup>6</sup> Braun, Max: *Die Thierischen Parasiten*. Würzburg (1903), 277.

<sup>7</sup> Estimates of the frequency of infection, without actual statistical proof, would appear to be absolutely unreliable. While from 50 to 100 per cent of the population of southern Italy was estimated to harbor whipworms, Cima's examination of 110 children gave only 37.27 per cent of infection. *Ascaris* had been estimated to be the most common intestinal parasite of man in the Philippines, but actual statistics show it to be about one-half as frequent as whipworms or hookworms. When the present investigation had proceeded to the examination of 1,000 patients, the author estimated that the percentage infected with whipworms would approach very nearly to 90, and even expressed such an opinion in a meeting of the local medical society; our final figures show only 59 per cent.

infection with whipworms reported from the tropics are due to the failure of workers in tropical countries to record whipworm infections.

A number of authors<sup>\*</sup> have found whipworm to be more common in females than in males and in children (under 15 years of age) than in adults and therefore it is probable that the actual frequency of the parasite in the Philippine population as a whole is higher than is shown by our figures, which are exclusively based upon the examination of adults and almost exclusively of males.

So far as could be determined from the records of the previous residences of the prisoners examined, the percentage of infections with whipworms appears to be about equal throughout the different provinces of the Islands.

#### INFECTIONS WITH HOOKWORMS.

(52 per cent.)

Hookworms, after *Trichuris*, were the parasites most frequently encountered (52 per cent). Much higher rates of infection with hookworms have been reported from other countries, but some of these, notably those detailed in the report of the Porto Rican Anæmia Commission, are not suitable for purposes of comparison, for the reason that the examinations were primarily directed to the study of hookworms, while in our own work hookworm infections were recorded no more faithfully than were those with other parasites.

Calvert, Fearnside and Dobson in India reported 83 per cent, 65.83 per cent, and 75.58 per cent, respectively, and with the exception of their comparatively low rates of infection with whipworms, these authors appear to have recorded all intestinal verminous infections impartially—their rates of total infections being 143, 104.9 and 107.28 per cent, respectively.

The recognized pathogenicity of hookworms, their relatively great importance from the view point of clinical medicine and public hygiene, and the seriousness of the problems presented by uncinariasis in other countries, urge us to depart here from a purely statistical presentation of the case and briefly to consider the clinical aspect of hookworm disease in the Philippines, so far as we have been able to determine it by observation and inquiry during the past year, in relation with the apparent frequency of hookworm infections.

While our figures show 52 per cent of the 4,106 prisoners which were examined to be infected with hookworms, clinical manifestations of uncinariasis were rare; in fact, cases of severe anæmia, in the absence of tuberculosis, malaria, or other anæmia-producing diseases, were practically absent. While hundreds of patients come from the provinces to the hospitals of Manila annually, general inquiry among the physicians elicits

<sup>\*</sup> Bull. Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash. (1906), 28, 70-71.

the information that although hookworm infections are common, they are usually first diagnosed in routine examinations of the feces and if severe anaemia is present, a concurrent infection of malaria, tuberculosis or of some other disease which would account for the condition exists. Furthermore, after careful and general inquiry among numerous medical officers of the Army, Navy, and the Bureau of Health who had served or were serving in the provinces, we have failed to obtain any knowledge of any general or marked prevalence of hookworm disease among the natives.<sup>9</sup> Accordingly, while further investigation may discover a greater frequency of uncinariasis in its severer forms than now appears to be the case, it would seem to be reasonably certain that there is no such prevalence of this disease with severe manifestations among the natives of the Philippines as we might expect in view of the apparent fact that over one-half of the population harbors this parasite.

Whether or not the explanation of this apparent rarity of clinical symptoms in hookworm infections among the Filipinos is a racial immunity on the part of the people to the toxins secreted by the worms, as has been suggested in regard to the similar condition found by Stiles in negroes in the Southern States, by the Anaemia Commission in Porto Rico and by Zinn and Jacoby in Africa, the fact that severe clinical manifestations of uncinariasis are rare in the Philippines materially alters the problem which is presented. Instead of producing an acute condition such as was presented in Porto Rico, St. Gothard Tunnel, the Westphalian coal mines, and in other places where uncinariasis prevailed in its severer forms, it would appear that in the Philippines hookworm infections play a part more nearly resembling that of the other common intestinal worms to which no definite pathology or severe symptomatology is usually attributed.

#### INFECTIONS WITH ASCARIS.

(26 per cent.)

Rates of infection with "round worms" have been reported ranging from 0.49 per cent (Stiles and Garrison, United States, 1906) to 50.97 per cent (Wellman, west Africa, 1904).

A compilation of statistics obtained from nearly 3,000 persons examined and reported upon by various authors, shows *Ascaris* to have been found almost twice as frequently in females as in males, as follows: Males examined, 1,732; infected with *Ascaris*, 138, or 7.97 per cent; females examined, 1,103; infected, 159, or 14.42 per cent.<sup>10</sup>

<sup>9</sup> The most severe case of hookworm disease seen by the author in Manila and the only one showing in a marked degree the cardinal symptoms of extreme anaemia, with cardiac murmurs, oedema, dyspnoea, and great weakness, was a Japanese male infected with the "Old World" hookworm (*Agchylostoma duodenale*).

<sup>10</sup> Bull. Hyg., U. S. Pub. Health & Mar.-Hosp. Serv. Wash. (1906), 28, 70-72.



A similar compilation with regard to age demonstrates that "round worms" are encountered with over twice as great frequency in children under 15 years than in adults of middle life, the number of children from 1 to 15 years examined being 2,381; those infected, 400, or 16.80 per cent; adults, from 15 to 50 years, examined, 1,461; infected, 107, or 7.32 per cent.

It is evident that our figures (26 per cent), based entirely upon adults and almost entirely on males, are considerably below the proportion of the total Philippine population harboring this worm, should a like sex and age relation with regard to *Ascaris* infections hold in the Philippines.

#### INFECTIONS WITH AMOEBÆ.

(23 per cent.)

Statistics regarding the frequency of *Amoebæ* in the human intestine have varied greatly in the percentage of infection found, numbers as high as 50 and even 70 per cent having been reported; a comparison is rendered more unsatisfactory by the fact that some authors have attempted to distinguish between *Entamoeba coli* and *Entamoeba histolytica* and others have not done so. In the work here reported no attempt at such differentiation was made after the investigation had progressed for a few weeks, for the reason that it was not found possible to differentiate the two species with any certainty in a routine microscopic examination of the fresh feces, and also because we are of the opinion that, until more light has been thrown upon the problems of the specific identity and the relative pathogenicity of intestinal amoeba, the only safe attitude to hold toward amoebic infection of the intestine in the Philippines is to consider all intestinal amoeba potentially pathogenic and to treat them accordingly. In view of such an opinion, the practical purpose of the investigation expressed in the introduction would be served by recording the frequency of infection with *Amoeba* without attempting a possible specific determination of the parasites.

A diagnosis of *Amoeba* was made only upon finding the motile organism. All encysted forms or cellular structures resembling the vegetative form of the parasite were reported to be negative with a query, and other examinations were made until the motile organism was observed or its absence rendered reasonably certain.

The percentage of infections with *Amoeba* among the 4,106 prisoners examined (23 per cent) agrees rather closely with figures previously reported by Musgrave and Clegg who found 154 (26 per cent) of 587 prisoners examined at Bilibid to have *Amoeba* in the feces.

## INFECTIONS WITH INTESTINAL PROTOZOA OTHER THAN AMOEBA.

(21 per cent.)

So many atypical forms of flagellates and forms, which could not with certainty be readily placed in known genera, were encountered that the attempt to differentiate all of these organisms was abandoned at an early period and the diagnosis was made under the general term, monads. The flagellate most frequently present was *Cercomonas*, probably the usual *Cercomonas hominis* of other localities. There were three infections with *Balantidium* and three with *Lambdia*.

As in the case of *Amoeba*, only the observation of the motile forms of these organisms was considered to be a safe basis for a positive diagnosis.

## INFECTIONS WITH STRONGYLOIDES.

(3 per cent.)

The statistics at command for the prevalence of *Strongyloides* are the following:

Strong, 1901, Philippine Islands, 2,179 persons examined, 13, or 0.6 per cent, infected; Daniels, 1901, British Central Africa, 251 persons examined, 3, or 1.50 per cent, infected; Wellman, 1904, West Africa, 310 examined, 2 or 0.65 per cent, infected; Anemia Commission, 1904, Porto Rico, 4,482 examined, 36, or 0.8 per cent, infected; Stiles & Garrison, 1906, United States, 3,457 examined, 8, or 0.23 per cent, infected.

Our figures (132 infections, 3 per cent) are somewhat higher than any hitherto reported. The diagnosis in every case was based upon finding the free embryo in specimens examined not more than four hours after the stool was passed.

To the best of our knowledge, hookworm ova, even in a tropical climate, never hatch in less than twelve hours after the faeces are passed.

## INFECTION WITH OXYURIS.

(0.8 per cent.)

As has been repeatedly pointed out by various workers, the microscopic examination of faeces for ova is not a reliable method for the diagnosis of the pinworm, for the reason that the migration of the adult female worm to the exterior prevents such a distribution of the ova through the faeces as occurs in the case of ova which are deposited in the intestine.

The highest rate of infection with pinworms reported from microscopic examination of the faeces was that of Dobson, in India, who found 15.37 per cent of 1,249 persons to be infected; the next highest, 10.98 per cent, was reported by Grechaninoff, in St. Petersburg, in 1890, upon the microscopic examination of the faeces of 583 persons.

Some statistics based upon findings at autopsy show higher figures. Both Gribbohm and Heller encountered a fraction over 23 per cent of infection with

*Oxyuris* in autopsies done at Kiel, and Banik reported 30.16 per cent found in 315 autopsies at Munich. Muller, however, found only 2.21 per cent in 1,939 autopsies at Dresden and 12.13 per cent in 1,755 autopsies at Erlangen.

This parasite is directly transmissible from one person to another by means of the freshly deposited ova in the faeces, thus making it a simple matter for one person to spread the infection among those in intimate personal association with him. The chief significance of our figures for *Oxyuris* (23 cases, 0.8 per cent) probably lies in the fact that they are a favorable commentary upon the sanitary condition of the prison and also, perhaps, upon the personal cleanliness of the Filipino of the lower classes; for it might naturally be expected that when from 200 to 400 men sleep side by side in close proximity as the natives do at Bilibid, favorable conditions would arise for the spread of pinworm infection if once it was introduced.<sup>11</sup> Although the microscopic examination of faeces is unreliable for the diagnosis of oxyuriasis, more cases would undoubtedly have been found had there been any widespread prevalence of the infection in the prison population.

It would appear that *Oxyuris*, like *Ascaris*, tends to occur more frequently in children than in adults and (to a less degree) in women than in men, the figures compiled from different authors being as follows: Males examined, 1,543; infected, 178, or 11.54 per cent; females examined, 810; infected, 115, or 14.20 per cent; adults (over 15 years) examined, 860; infected, 39, or 4.54 per cent; children (under 15 years) examined, 1,272; infected, 305, or 23.97 per cent.<sup>12</sup>

Our figures (0.8 per cent) for adult males may safely be presumed to be below the percentage of infection in the total population of the Philippines.

#### INFECTIONS WITH TÆNIA.

(0.7 per cent.)

Rather well-defined distinctions are given between the ova of *Tænia saginata* and *Tænia solium*, but we do not consider them to be sufficiently constant and well marked to make a differential diagnosis between the two species practical from a microscopic examination of the ova alone in the general run of cases. Therefore, the distinction was not attempted unless segments of the worms were obtained. As has been

<sup>11</sup> As an example of the tendency of *Oxyuris* infection to spread among persons in intimate contact, we may cite the case of a single ward in a hospital for the insane, which came under our observation in the United States. Of the 45 men in the ward, 11, or 24.44 per cent, were infected with pinworms; five other wards in the same building gave 1, 2, 0, 2, and 1 infections, respectively.

In the remaining 36 wards in other buildings (796 patients) there were only 8 infections with this parasite. *Bull. Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash. (1906), 28, 56, 61.*

<sup>12</sup> *Bull. Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash. (1906), 28, 71-72.*

shown in an earlier paper,<sup>13</sup> the relative number of adult specimens of *T. saginata* and *T. solium*, deposited in the Helminthological Collection of the Bureau of Science, indicated a considerably greater prevalence of the former species.

Figures for the frequency of infection with the beef and the pork tapeworms in different localities have ranged from 0.06 to 3.66 per cent for the former and from 0.02 to 3 per cent for the latter species. Several authors have reported no infections found in large series of cases examined.<sup>14</sup>

#### INFECTIONS WITH PARAGONIMUS.

(0.4 per cent.)

The infections with lung flukes here reported were diagnosed by finding the ova in the feces. In most of the cases they were also found in the sputum and it can not be excluded that they were present in the sputum in all cases and reached the intestines as a result of the swallowing of the eggs.<sup>15</sup>

*Geographic distribution.*—The history of the 18 patients infected with *Paragonimus* with regard to place of residence before commitment to the prison was as follows: One from Manila, one from Cavite, one from Camarines Norte, one from Albay, two from Sorsogon, four from Samar, six from Leyte, and two from Mindanao.

The central and northern provinces of Luzon were fully as well represented among the prisoners examined as were the southern provinces and the southern islands of the Archipelago, yet no patient infected with *Paragonimus* gave a history of residence north of Manila and, with the exception of the cases from Manila and Cavite, in neither of which could the possibility of previous residence in the southern provinces be eliminated, all instances of paragonimiasis gave a history of origin in the islands south of Luzon or in the peninsula forming the southern extremity of that island.

<sup>13</sup> *This Journal*, Sec. B., (1907), 2, 537.

<sup>14</sup> *Bull. Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash.* (1906) 28, 66-67.

<sup>15</sup> It would appear from our experience, that the value of examination of the feces in the diagnosis of paragonimiasis has not been sufficiently emphasized, the examination of the sputum alone being usually stated as the method for diagnosis. In several cases, repeated examination of the sputum was necessary before ova could be found, although they were present almost constantly in the stools. When found in the sputum they were usually more abundant than in the feces. If, as appears, the discharge of ova of the lung fluke in the sputum is, in some cases at least, intermittent, it is not illogical to suppose that the ova swallowed with the sputum become more or less scattered along the alimentary tract and are discharged more gradually, in less concentration, but with relatively greater constancy in the feces. We would suggest, therefore, the value of microscopic examination of the feces as well as of the sputum in the diagnosis of lung-fluke infection.



Therefore, the conclusion would appear to be warranted that infection with lung flukes is not evenly distributed throughout the Philippines, as appears to be the case with the parasites above considered, but that it is to be found chiefly in the southern portions of the Archipelago.

It is quite within the bounds of probability that the distribution of this parasite may be found to be even more strictly localized. To the best of our knowledge, all cases of paragonimiasis reported for the Philippines, in which the history of previous residence was known, have originated in the southern part of the Islands, and further investigation may show the infection to be *confined* to this region. The possibility can not be excluded that the infection is limited more or less strictly to certain of these southern islands. Some indication of this was found in our own figures. For instance, 239 prisoners from the Island of Leyte were examined and 6 had paragonimiasis; 12% prisoners from the Island of Samar gave four infections with lung flukes; on the other hand, while 248 prisoners from Panay were examined, no fluke infections occurred. However, until the matter has been further investigated, we believe that the only generalization justified by our results is as already stated: namely, that paragonimiasis prevails in the southern rather than in the northern parts of the Philippines.

#### INFECTIONS WITH SCHISTOSOMA JAPONICUM.

(0.6 per cent.)

The use of the specific name seems desirable in the present case in order to differentiate *Schistosoma japonicum* from *S. hamatobium*, all of our infections being with the former species.

*Geographical distribution.*—As in the case of *Paragonimus*, the apparently uneven geographical distribution of *Schistosoma* infections appears to be of greater interest and importance than the actual percentage of infection found among the prisoners examined. The cases of schistosomiasis were distributed geographically as follows: Manila, 1; Samar, 6; Leyte, 5; and Mindanao, 4. Therefore, excepting the one case from Manila, all infections with *Schistosoma* appear to have originated on the three southern islands, Samar, Leyte, and Mindanao.

#### INFECTIONS WITH OPISTHORCHIIS.

(0.3 per cent.)

*Racial and geographical distribution.*—In only five of the eleven cases of opisthorchiasis could a definite history of previous residence be obtained. Three of these came from the Island of Mindanao, one from

Rizal Province, Luzon, and one from Nagasaki, Japan. Five of the prisoners having *Opisthorchis* infections were Chinese, five were Filipinos, and one was Japanese.

The results for *Opisthorchis* are not sufficiently complete to show any marked inequality of distribution among different localities. However, there does appear a relatively greater prevalence of this parasite among the Chinese. In one case it was certain that the infection was contracted in China; but in the other instances this point could not definitely be determined.

#### INFECTIONS WITH HYMENOLEPIS.

(0.1 per cent.)

Four of the five infections with *Hymenolepis* were with the "dwarf tapeworm" of man, *H. nana*; the remaining one was with *H. diminuta*.

Statistics by several authors show that the dwarf tapeworm is consistently more common among children than among adults, and therefore we would expect our figures to be somewhat higher for this parasite had children been included among the cases examined.

#### DISCUSSION.

The purpose of the investigation, as was stated in the introduction, was to obtain accurate knowledge of the prevalence and distribution of animal parasites among the Filipinos so as to secure more definite judgment regarding the importance of animal parasites as factors in determining the hygienic and industrial condition of the people, and to obtain a clearer idea in regard to the nature and magnitude of the medical and sanitary problems presented and, perhaps, also to make some contribution toward their solution.

The results of this investigation show one of the most striking instances in the history of medicine of a population almost universally infested with animal parasites; and the medical and sanitary problems presented would seem to offer three rather distinct aspects, namely, the infections with intestinal protozoa, chiefly *Amoeba*, the trematode infections, and the infections with intestinal worms.

The situation in the Philippines in regard to amoebiasis is involved in differences of opinion both as to the specific identity of *Amoeba* found in the intestine and to their pathogenicity. Whether or no the validity of Schaudinn's *Entamoeba histolytica* and *E. coli* and the nonpathogenic nature claimed for the latter species be ultimately established, we are forced to believe, as we have already indicated, that in our present state of knowledge the only safe position for the medical man to hold in

the Philippines toward amœbic infections is to consider all intestinal *Amœba* as potentially pathogenic.<sup>15</sup>

Accepting such a view, our figures would appear to prove from a statistical view point the wide prevalence of amœbiasis already recognized by clinicians and to emphasize the extreme value of the prophylactic measures urged by the Bureau of Health and the great need of rapidly extending sanitary measures against this parasite. The magnitude of the problem appears when we consider that if our figures for the Bilibid prisoners (23 per cent) be applied to the total population of the Islands, from 1,500,000 to 2,000,000 people in the Philippine Islands harbor intestinal *Amœba*.

The unsolved biological problems in connection with *Paragonimus*, *Schistosoma* and *Opisthorchis*, involving their embryonic development, and intermediate hosts and modes of infection, leave us only general measures of treatment and of prophylaxis in these infections. The apparent localization of *Paragonimus* and *Schistosoma* in the southern part of the Islands renders our figures of little statistical value, and further work in the localities in question will be necessary in order to determine their actual frequency of infection in infected localities.

The situation in the Philippines in regard to the prevalence of intestinal worms calls for special consideration because of the high rate of infection found, the peculiar character of the hookworm situation, and because these infections are apt to be lightly regarded in the tropics.

The prisoners at Bilibid showed an average of 142 infections with intestinal worms for each 100 examined. Fifty-two per cent were infected with hookworms, but it would appear that these parasites do not produce the serious effects in the Filipino that they do in other races; hence, they should be placed in the same category with other intestinal worms.

While it is generally recognized that verminous infections of the intestine are indirectly and in an indefinite degree injurious, it is extremely difficult to obtain and it is practically impossible to demonstrate any accurate measure of the injury done. So far as we are aware, the work which by its results has come nearest to demonstrating the

<sup>15</sup> It would not be within the purpose of the present paper to enter into a discussion of the merits of the questions regarding the specific identity and relative pathogenicity of intestinal *Amœba*. If all intestinal *Amœba* are pathogenic, it is a rather startling condition of affairs to find 23 per cent of a population harboring this parasite; but it would appear that such a view is rather in harmony than otherwise with the frequency of amœbic lesions found at autopsy. In this connection, the reader is referred to earlier publications of Musgrave and Clegg in the Philippine Journal of Science, and to Gilman's report upon a series of 100 autopsies at the Philippine Medical School which appears in the current number.

effects of infections with intestinal worms upon the health of a population is that carried on by Dr. Shattuck of the Bureau of Health at Bilibid Prison during the time our own investigation was in progress, the results of the same examinations being used as far as practicable in both investigations.

These results have been placed at our disposal by Dr. Heiser, Director of Health, from the manuscript of his Annual Report for 1906-7, and are briefly as follows:

The annual death rate in the prison when it came in charge of the Bureau of Health was 238 per one thousand. The institution of general measures of sanitation reduced this rate to 75 per one thousand where it remained stationary, resisting further reduction. Up to this time little attention had been paid to infection with intestinal worms. In the latter part of 1906, systematic treatment of the prisoners for intestinal worms was begun and vigorously carried out until practically the entire population of the prison had been treated. Following, and, in Dr. Heiser's opinion, largely as the result of this antihelminthic campaign among the prisoners, the death rate dropped to 13 per one thousand per annum.

Whether or not this apparent relationship between intestinal worms and the death rate at Bilibid will be substantiated by future records at the Prison, or would be confirmed by the institution of a similar campaign throughout the Islands, its significance can scarcely be overestimated even though ultimately the results should prove to be but a fraction of what was apparently accomplished among the Bilibid prisoners. It moreover sharply emphasizes the fact that the absence of direct, acute manifestations of intestinal helminthiasis should not blind us to the vital importance of these infections as factors in determining the hygienic condition of a people.

Applying the rates of infection obtained from the 4,106 prisoners examined at Bilibid to the total population of the Islands (about 7,000,000), it would appear that about 5,000,000 persons in the Philippines are infected with intestinal worms and that the inhabitants of the Islands harbor over 9,000,000 infections. The magnitude of these figures indicates in part the tremendous proportions of the problems involved in any radical movement toward improvement of existing conditions, especially when we consider that the situation does not appear to be simplified by any marked confinement of the infections to limited areas. Even a casual knowledge of sanitary conditions prevailing throughout the Islands throws additional light upon the difficulties to be encountered and leads to the question whether it is practicable at the present time to institute special prophylactic measures directed toward the eradication of intestinal worms, or whether we must content ourselves with the gradual sanitary improvement of the country.



In this connection, one practical suggestion would seem to offer itself. The source of all infections with intestinal worms, followed back to its origin, is necessarily the feces of persons already infected.<sup>18</sup> With this fact in mind, we have carefully inquired into the different methods of the disposal of excreta customary among the Filipino people and it would appear that it would scarcely be possible to establish more ideal conditions for the spreading of intestinal parasites throughout the Islands. The native, if living near a stream, defecates along its banks, either in, or at varying distances from the water; in the rainy season, the streams overflow their banks and naturally scatter any infection, they carry over the adjacent country. Another manner of disposing of the feces, equally or perhaps more prevalent, is simply through a hole in the floor of the bamboo house, the excreta falling to the ground to be partly devoured and partly scattered about by the universally present hogs and chickens.

Such conditions go together with the extremely high prevalence of intestinal worms among the people, and we can scarcely escape the conclusion that the one sanitary measure preëminently demanded for the prevention of infection with intestinal worms in the Philippines is a proper disposal of human excreta. In fact it would appear scarcely too strong a statement to say that the spread of infections with intestinal worms could be in time satisfactorily controlled by the proper establishment of this measure alone. The urgency of the demand for a proper disposal of human excreta is further emphasized by the effect which it might reasonably be expected to bear directly upon the prevalence of other diseases, in that it would lessen the distribution of pathogenic organisms other than animal parasites which escape in the feces.

To devise a working system, practical, economical, and adapted to Philippine conditions, is a special problem which requires special and, perhaps, experimental study. That a radical sanitary measure can be effectively and promptly enforced in the Philippines has been strikingly exemplified by the campaign of vaccination against smallpox so successfully carried out by the Bureau of Health.

In conclusion, we believe that the most valuable practical lesson to be drawn from the results of the examination of the Bilibid prisoners is the imperative need of establishing throughout the Philippines a system for the proper disposal of human excreta. Moreover, it does not seem unreasonable to expect, in the light of the striking results apparently accomplished at Bilibid by treating infections with intestinal worms, that with the reduction in the present exceedingly high prevalence of

<sup>18</sup> Those cases in which the parasite may infect other animals as well as man would, of course, constitute rare exceptions to this statement; for example, *Hymenolepis* in rats, *Tania solium* in hogs.

intestinal worms in the population, the general hygienic condition of the people would be improved to such a degree that there would follow a material reduction in the present high rates of morbidity and of mortality from tuberculosis and other prevailing diseases.<sup>17</sup>

<sup>17</sup>The following resolution was unanimously adopted at the recent annual meeting of the Philippine Islands Medical Association, held at Manila, February, 1908:

"Whereas, it would appear that the rate of infection with intestinal worms is higher among the Filipinos than has ever been definitely reported for any other people; and

"Whereas, it would appear further that the death rate at Bilibid Prison has been materially reduced following the treatment of the prisoners for these infections; and

"Whereas the spread of infection with intestinal worms can be controlled almost absolutely by the proper disposal of human excreta; and

"Whereas, the proper disposal of human excreta would, at the same time, remove one of the most dangerous channels for the dissemination of other infectious diseases: Therefore, be it

*Resolved*, That the Philippine Islands Medical Association does petition the Government of the Philippine Islands, through the honorable the Secretary of the Interior, that a commission of five properly qualified members be appointed to decide upon the most practical and efficient methods for the disposal of human excreta that can be established in these Islands and that such appropriation be made and such means provided in accordance with the report of this commission as may be necessary to put<sup>18</sup> into effect a practical and expedient working system for the disposal of human excreta."

## A REPORT ON THE FIRST ONE HUNDRED AUTOPSIES AT THE PHILIPPINE MEDICAL SCHOOL.

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There have been a large number of autopsies performed by the Bureau of Government Laboratories and its successor, the Bureau of Science since the American occupation of these Islands. While in the cases of acute infectious diseases the diagnoses have been carefully made and recorded, and in other special cases full protocols have been preserved, in general the records are not adapted to furnish the basis for a complete statistical study of the relative frequency with which the different chronic diseases occur. A systematic study has been made, by gross and histologic methods, of the pathologic material, and complete records of the findings have been kept since the opening of the Philippine Medical School, in the department of pathology and bacteriology organized by Dr. H. T. Marshall. The examinations are made according to the usual Virchow routine, and are designed especially to furnish material and records for a general statistical inquiry. The routine includes the preservation of pieces of the organs in Zenker's fluid and subsequent histologic examinations.

No unusual efforts have been made to discover remote foci of tuberculosis or syphilis, and the examination for the presence of intestinal parasites has not been altogether complete. Cultures were made in only a few instances. The nerves were examined for degenerations in only one or two cases in which a clinical report rendered the diagnosis of beriberi probable.

The following report is based upon the findings in the first one hundred autopsies performed at the Philippine Medical School between August, 1907, and January, 1908. Although the number of cases is comparatively small, these findings should give a good conception of the relative frequency among the lower classes of Filipinos of the commoner diseases, with the exception of the acute epidemic ones, for the bodies came from the free wards of the large hospitals and from the poorer quarters of the city of Manila. Cholera, smallpox, leprosy, etc., are treated only in the special hospital for these diseases, and such conditions would not enter into our records except on rare occasions.

Of the 100 bodies examined, 67 were males and 33 females, 97 being Filipinos and 3 Japanese. As is shown in the following table, the third and fourth decades contributed the greatest number of cases, these two furnishing nearly equal numbers:

Decade.	Male.	Female.	Total.	Decade.	Male.	Female.	Total.
1	7	7	14	6	7	2	9
2	5	5	10	7	4		4
3	17	8	25	8	3	2	5
4	16	6	21	9	1	2	3
5	8	2	10	10		1	1

Tuberculosis was found to be the cause of death in 35 of the cases; pneumonia in 27; chronic cardiac disease and arterial change in 6; nephritis in 5; typhoid fever, beriberi, and septicæmia each in 4; amebic dysentery and acute bacillary dysentery each in 3; acute endocarditis in 1; carcinoma in 2; and acute pleurisy, acute peritonitis, splenomegaly, cerebral abscess, cerebellar hæmorrhage, and acute yellow atrophy each in 1 case.

#### TUBERCULOSIS.

Tuberculous lesions were found forty-five times in the series of 100 cases, and tuberculosis was the cause of death thirty-five times; 22 of these cases were males and 8 females. The autopsy on the youngest person was of a child 1 year old, on the oldest, of a man of 90 years. The greatest number of cases, 18, occurred between the ages of 25 and 35, the next greatest, 12, between the ages of 45 and 55 years.

The disease was confined to the thorax in 21 cases, to the lungs and alimentary tract in 6, to the lungs and kidneys in 2, to the peritoneum in 4, and was a generalized process in 2. Nearly an equal number of the cases occurred in people who had lived in the country and in those coming from the city of Manila proper, in both of which situations the elevation of the land is very little above that of the sea level.

The large amount of lung tissue involved was of particular interest in the cases of pulmonary tuberculosis. In six instances the greater part of all the lobes of both lungs was thickly studded with lesions. Complete, massive involvement of both upper lobes occurred in 7, one entire lung and at least one lobe of the opposite lung were involved in 2, the entire upper right lobe in 3, and the left in 2 cases. The left upper lobe was diseased in 26, the right upper lobe in 23 cases.

The type of tuberculous lesion most frequently met with consisted of a chronic ulcerated condition in which ragged, irregular cavities, frequently of great size, connected with one another and with bronchi. This



condition was found to a greater or less degree twenty-seven times, or in about 90 per cent of the cases of pulmonary involvement.

Histologically, the irregular, ragged walls of these cavities were in the majority of instances not definitely limited by any marked reaction on the part of the surrounding lung tissue. A definite formation of new fibrous tissue was found in but one-third of the cases and this zone was nearly always lined with a layer of newly formed tuberculous tissue.

Extensive areas of consolidation were frequently found associated with the cavity formation, and in a contiguous portion or adjoining lobe great showers of miliary and conglomerate tubercles were encountered.

The pleura was involved in all cases, the involvement consisting in a chronic, fibrous thickening and obliteration of the cavity which varied from a localized area to complete union of the surfaces. In addition to the cases of tuberculosis, pleural lesions were found very frequently, 50 per cent of the cases included in this report showing some pleural involvement.

Tuberculous peritonitis was the cause of death in four cases. One of these showed a small, active focus of the disease in the lungs, one an apparently healed apical lesion, and after a prolonged search the other two revealed no pulmonary involvement. Tuberculosis of the vertebræ occurred but once and of the bladder three times; psoas abscess was also present once. Latent tubercular lesions were found in the lungs in but 2 of the 100 cases, and healed foci occurred in but 6.

In connection with this evidence of the virulence of the tubercle bacillus, it is interesting to note that cultures of the organism obtained by subcutaneous inoculation of guinea pigs and subsequent transference from their glands to suitable media, were kept alive with considerable difficulty and soon died out after a very sparse growth.

#### PNEUMONIA.

Pneumonia was the cause of death in 27 cases, 11 of these being croupous or lobar, and 16 broncho-pneumonia, the majority of the cases occurring in young adults and three-fourths coming from the city proper. A summary of the cases of lobar pneumonia shows that all lobes of both lungs were involved in 1 case, the entire right lung in 1, the left lower lobe in 5, the remaining 4 cases showing involvement of but one lobe. All were accompanied by an exudation of a fibrinous nature upon the pleural surface of the involved lung.

Death in this series of 11 cases occurred early in the disease in four instances, and during the stage of red hepatization in two instances. In the former, the tissue involved was in an early stage of engorgement with greatly distended capillaries and swollen epithelium surrounding but a small number of red corpuscles. The remaining five cases showed typical, gray hepatization.

Unresolved pneumonia was found in one case, with typical fibroid induration of the entire lobe. The patient died of an acute beriberi.

The following complications of pneumonia were presented: endocarditis in 2 cases, pericarditis in 1, nephritis in 5, and pleurisy in all but 2 of the early cases.

Primary broncho-pneumonia occurred in 3 of the 15 cases of this disease; all of these being in children of 3 years of age. Seven cases of the secondary form of disease had developed during the course of infectious diseases and 5 were in old, emaciated subjects and were of the aspiration or deglutition type.

Other pulmonary lesions were encountered in the routine examination of the organs from autopsies, as follows: oedema and congestion in 27 cases, infarction in 5, and emphysema in but 2 cases.

#### HEART AND BLOOD VESSELS.

Death could be ascribed to chronic cardiac change associated with arterial degeneration in but 6 of the 100 cases, but it is also true that a normal heart was the exception, some change in or within the walls occurring in 62 instances. In 4 of the above-mentioned 6 cases, an acute dilatation of an hypertrophied organ was found associated with more or less rigid curling of the mitral valves and damage to the lining of the aorta; in the other two cases, there was a marked grade of fatty infiltration, the muscle fibers being completely occupied with rows of small globules. Stenosis was observed but once, the mitral orifice being affected.

The common type of heart found in the majority of instances was a flabby, relaxed, more or less dilated organ, showing practically no attempt at hypertrophy. The heart muscle in these cases was pale brownish or yellowish-brown in color, possessed a turbid appearance and was very soft. Histologically, the fibers showed varying grades of granular degeneration. Fragmentation was frequently observed and in the greater number of the specimens studied very little new formation of scar tissue had occurred. A condition of relative insufficiency was found in 26 cases.

Acute disease of the endocardium followed an operation for imperforate anus in a child of 5 days, and occurred as a complication of pneumonia twice. In each of the cases there was a vegetative inflammation of the mitral valves.

Acute myocarditis was present in five instances, four in cases of beriberi and one in acute yellow atrophy of the liver. Acute pericarditis occurred once in a child of 1 year and 8 months, who died of broncho-pneumonia.

Arterial changes were the exception in this series of examinations. The vessels in only 6 of the 100 bodies showed thickening and loss of elasticity and of the 6, but 2 evidenced a marked grade of degeneration

with scattered plates of calcification confined to the abdominal aorta. The other 4 showed numerous flat, yellowish, oval projections scattered over the surface of the aorta near its origin. No change more marked than a partial loss of elasticity was encountered in the vessel walls, even in cases over 60 years of age. Arterio-sclerosis was found in but one of the 25 individuals infected with tuberculosis.

Aneurism was not encountered in any of the series, nor has a case been admitted in the hospital wards or been seen among the patients of the large free clinic at St. Paul's Hospital during the past eight months.

#### DISEASES OF THE KIDNEYS.

Lesions of the kidneys occurred more frequently than one might expect from the generally good condition of the arterial tissue. Of 100 cases, nephritis was present in 48, acute in 23 and chronic in 25. Retention cysts occurred in 7, infarcts in 2, and tuberculous foci in 4 cases.

The kidneys usually appeared swollen and markedly congested in the instances of acute nephritis, the capsule stripping readily and leaving a dark, smoky surface. Histologically, the glomerular changes predominated, the capsules and tubules frequently containing red and a few white blood cells. The swelling and granular appearance of the tubular epithelium was in most instances less marked than the glomerular change.

The kidneys with chronic nephritic changes were of the large, pale type in 6, and the small granular in 19 cases. Two cases of the first group showed large, pale, swollen organs with numerous opaque areas scattered over the smooth surface beneath the capsule; the pale cortex forming a sharp contrast to the darkly injected pyramids. Histologically, the tubules, glomeruli, and interstitial tissue were all more or less involved in the inflammatory process. The four other cases of this group evidenced somewhat small, pale kidneys with thickened capsules and roughened surfaces. Glomerular degeneration and a rather marked grade of of interstitial change was present, hyaline changes being frequent.

Contracted, roughened kidneys with firmly adherent capsules were found in seven instances in the remaining nineteen cases of chronic nephritis. The capsules covered small cysts. This type of kidney could only be cut with increased resistance; it showed an attenuated cortex which contained a greatly increased amount of interstitial tissue, with marked degenerative and atrophic changes in the glomeruli and plugging of distorted tubules with debris. The arterial change in these cases of chronic nephritis is less marked than the general change in the organs would lead one to expect, with the exception of those cases in which there was a general arterio-sclerosis.

Fatty degeneration of the kidney was found in 4 cases, 3 of which died of tuberculosis and 1 of amoebic dysentery.

The suprarenal bodies were tuberculous in two instances, both of which contained, in addition, marked pulmonary lesions.

## SEPTICÆMIA.

Death from a septicæmia advancing from local infection occurred in 4 cases. The post-partum uterus served as the point of entrance in 1 instance, in 2 the foci resulted from compound fractures, and in the fourth, a small pustule on the lower lip was the beginning of the infection. It is of interest to note that in none of these cases was a streptococcus demonstrated. *Staphylococcus aureus* and *albus* and *Bacillus pyocyaneus* were obtained from the body in which infection had taken place from the lip and also from the puerperal case. Judging from the difficulty experienced in endeavoring to obtain a culture of the *Streptococcus pyogenes*, for class work in the Medical School, this organism does not play as important a rôle in the Philippines as it does in other parts of the world.

## LESIONS OF THE ALIMENTARY CANAL.

The condition of the teeth in this series was bad. Black, discolored cavities and decayed areas were frequent. The gums were irregular and receding and pyorrhœa alveolaris was common.

Disease of the hard palate, a perforation probably of a syphilitic nature, occurred in one case.

Chronic ulceration of the stomach occurred once, the punched-out ulcer with irregular edges lying on the greater curvature, 5 centimeters from the cardiac orifice. An acute hæmorrhagic inflammation of the mucosa of the stomach occurred in two cases, dead of beriberi.

One instance of malignant disease of the stomach was encountered. The tumor, an adeno-carcinoma, infiltrated the lesser curvature of the organ from the cardiac orifice to within 3 centimeters of the pylorus. The surface of the tumor within the stomach was ulcerated and surrounded by a rolled, irregular edge. The stomach was adherent to the pancreas and the under surface of the liver, the latter being infiltrated with scattered metastatic growths.

Two of the cases of pneumonia and one of chronic Bright's disease showed an acute colitis with a thin layer of exudate on a markedly congested base. In one case of acute nephritis, the solitary follicles of the ileum were enlarged and many were topped with areas of necrosis. Ulceration in the ileum was present in all of the cases of typhoid fever.

One hundred appendices were examined; 19 were over 12 centimeters in length, 6 showed a chronic obliterative process, 7 contained faecal masses and adhesions were present four times. The appendix in 24 cases was found to extend dorsally around the end of the cæcum and up between the cæcum and the parietal peritoneum.

Death from acute bacillary dysentery occurred in three cases. Two of these were in Japanese brothers, aged 2 and 4 years, dying the same day.

The lesions most frequently met with in the entire series of cases were ulcerations of the large bowel. The lining of the large intestine in 32 cases showed active amœbic ulcerations of typical appearance, while in 22 additional individuals there were abundant evidences of previous lesions as shown by numerous, irregular pigmented scars and depressions. While these lesions were spread generally over the entire extent of membrane from the ileo-cæcal valve to the rectum, in 11 cases the ulcerations were confined to the terminal few centimeters of the rectum.

Intestinal worms were found in 32 cases, *Ascaris lumbricoides* alone in 17, *Trichocephalus dispar* in 7, and the two together in 8. A liver fluke, *Opisthorchis sinensis*, was encountered in one body.

A persistent Meckel's diverticulum was present in a female child, dead of pneumonia, and an imperforate anus in a male child.

#### LESIONS OF THE LIVER.

Only one case of abscess of the liver occurred in the series. The body was that of a Japanese aged 36, in whom the entire large bowel was lined with amœbic ulcerations. The abscess occupied the lateral portion of the right lobe of the liver and measured 10 centimeters in diameter. The cavity was limited above by the diaphragm and contained a thick, yellow-brown pus. Numerous amœbæ appeared in the sections of the wall of the cavity.

The livers from 2 cases of typhoid fever, 1 of broncho-pneumonia, and 2 of pulmonary tuberculosis, showed well-marked areas of focal necrosis, in addition to a general parenchymatous degeneration. In 38 cases the same organ evidenced chronic passive congestion. The enlarged, dark red, firm organ was more frequent than the so-called "nutmeg" liver. The majority of the 38 cases were those of patients dead of pulmonary tuberculosis, and in addition they showed degenerative changes in the myocardium.

A mild grade of fatty infiltration was demonstrated in 17 of the livers from cases of tuberculosis and a very marked grade in 4 additional instances, 2 of tuberculosis, 1 of amœbic dysentery, and 1 of chronic heart disease. The general picture in the series of sections of fatty livers was of large fat-droplets occupying the greater part of an entire cell and often causing complete disappearance of the cell plasm.

Amyloid occurred in the livers in two of the tuberculous cases.

In nine cases the liver was the seat of cirrhotic changes. The organ was generally enlarged and firm. Three of the cases had fluid in considerable amount in the peritoneal cavity. The new tissue throughout the liver substance was rather closely confined to the periphery of the lobules, often inclosing groups of several lobules, the inclosed cells showing atrophy. Of the 9 cases, 5 died of pulmonary tuberculosis, and 1 of peritoneal tuberculosis. No marked "hobnailed" liver was

found. Acute, yellow atrophy of the liver occurred in one case, that of a woman 20 years old in the fifth month of pregnancy. The liver measured 18 by 5 centimeters; the edge was rounded, the organ was soft and of an opaque, grayish-yellow, mottled color. The organ was largely made up of degenerated and necrotic cells, irregular collections of fat-droplets and detritus.

There was but one instance of neoplasm of the liver, which occurred in the case of gastric carcinoma; the liver showed numerous metastases distributed throughout its substance.

#### PERITONEUM.

The single case of acute peritonitis followed a stab wound in which an opening into the descending colon had occurred.

In four cases, in addition to those of ascites associated with cirrhosis of the liver, there was a large amount of peritoneal effusion. One of these was associated with splenomegaly, two with cardiac failure, and one with nephritis.

#### LESIONS OF THE SPLEEN.

An acute swelling of the spleen was found in ten instances, in cases of typhoid fever, septicæmia and pneumonia. A chronic enlargement of this organ was encountered in sixteen instances, its enlarged condition apparently having no direct connection with the disease causing death. A chronic, indurative splenitis with a diffuse extensive formation of connective tissue was the rule in these specimens. The capsule, more or less thickened, had lost its smooth surface and was not infrequently ridged and seared. The organ was firm, although not hard, and usually increased in size and weight.

The cut surface of this type of spleen was of a uniform, red-brown color and crossed in all directions by a prominent interlacing framework of connective tissue. As a rule, the Malpighian bodies could not readily be distinguished. Microscopically, the finer connective tissue framework was increased or thickened and there was generally an increase in the number of parenchyma cells. Pigmentation was uncommon. It was observed four or five times and then the areas were made up of extremely fine, brown-black granules.

An atrophied spleen, wrinkled and firm, with prominent Malpighian bodies and decreased parenchyma, occurred in four cases, of which three were in patients who had lived to over 80 years, the other being an emaciated woman of 45, dead of carcinoma. The spleen in the series of cases of tuberculosis was the seat of tuberculous foci in two instances.

A single case of splenomegaly was encountered. The spleen weighed 1.2 kilos. The body was that of a well-nourished laborer 33 years old; the peritoneal cavity contained 2 liters of pale, turbid fluid, although



there was no cirrhosis of the liver. The enlarged spleen was attached by oedematous adhesions to the former organ, the stomach, kidney and bowel. The thymus and lymphatic glands were not enlarged. There were eleven smaller accessory spleens, measuring from 0.5 to 1.8 centimeters in diameter, extending in an irregular chain along the tail of the pancreas from the hilum of the main organ to the mid-line of the body. The accessory organs showed a shrinkage of the Malpighian areas and proliferation of the endothelial lining of the cavernous spaces in common with the main organ.

In addition to the above case, accessory spleens were encountered in three other subjects.

#### LYMPHATIC SYSTEM.

The bronchial lymph glands were involved in 27 of the tuberculous cases. A general involvement of the mediastinal glands also occurred in 3 cases. The bronchial glands were diseased twice in company with the mesenteric, and in 3 other cases the latter showed a general involvement alone.

The glands of the axilla were enlarged in but one instance in the entire series of cases. The glands of the groin, on the other hand, were found as a rule to be somewhat enlarged and firm. Histologically, they showed an increased growth of reticular tissue. Old scars, proving previous abscess formation in the glands of the groin, were found in two cases. In none of the glands could signs of syphilitic induration and cell change be detected, and in but one case was there evidence of a primary syphilitic lesion. In this instance there was a perforation of the hard palate.<sup>1</sup>

#### NEOPLASM.

Carcinoma as a cause of death was found twice, once involving the stomach, and once the cheek and antrum. There is a belief prevalent among some medical men that malignant disease is rare in this part of the world, but if reference be made to records of the department of surgical pathology this is shown not to be the case. Of 100 specimens sent from the surgical clinic at St. Paul's for routine examination, 6 were malignant, 4 sarcomata, and 2 carcinomata. The sarcomata were all of periosteal origin and of the lower limb.

There was one case of dermoid cyst of the ovary among the autopsies, the tumor measuring 14 centimeters in diameter. It contained several areas of calcification, in addition to the usual cuticular structures.

Uterine myomata—all subserous—were found in 3 cases.

<sup>1</sup> This case was clinically considered one of gangosa.

## NOTES ON THE CONDITION OF THE LIVER IN SCHISTOSOMIASIS.<sup>1</sup>

By J. M. PHALEN and HENRY J. NICHOLS.<sup>2</sup>

### I. INTRODUCTION.

### II. CASE RECORD.

### III. PATHOGENESIS OF THE CIRRHOSIS OF THE LIVER.

### IV. COMPARISON OF INFECTION WITH *SCHISTOSOMUM JAPONICUM* AND *SCHISTOSOMUM HÆMATOBIMUM*.

### V. GEOGRAPHICAL LOCATION.

#### I. INTRODUCTION.

*Schistosomum japonicum* was discovered and described as recently as 1904, although the disease which it produces had been recognized in Japan for nearly two decades previously. Outside of a small area in Japan, cases of infection with this blood fluke are still so infrequently seen that each one is worthy of report and discussion, as such reports will aid in locating the geographical distribution of the parasite and in clearing up its life history and pathologic effects. In discussing the present case, we wish to speak particularly of the pathologic findings in it and in other recorded cases, and to draw a contrast between these and those of infection with the closely allied *Schistosomum hæmatobium*.

#### II. CASE RECORD.

The patient, P. O., was admitted on January 16, 1908, to Dr. Ruffner's service in the Division Hospital in this city, and died on the following morning. He was a Filipino soldier 30 years old, belonging to a Visayan Scout company, single, and a native of Calbayog, Samar, in which town he lived continuously until his twenty-fourth year. He then enlisted and during the six years of his service was stationed on the Islands of Panay, Cebu, Leyte and Samar. He had never been out of the Visayas except for short visits, and he was on furlough in Manila when he entered the Division Hospital. The sick record of his company shows that during the six years of his service he was in hospital one hundred and nineteen days and in quarters eighty-three days, although the causes of admission to sick report are not given.

<sup>1</sup> Read at the Fifth Annual Meeting of the Philippine Islands Medical Association, Manila, February 27, 1908.

<sup>2</sup> Captain, Medical Corps, United States Army, and first lieutenant, Medical Corps, United States Army, constituting the United States Army Board for the Study of Tropical Diseases, as they occur in the Philippine Islands.

When he was admitted to the Division Hospital he was suffering from diarrhoea and cramps. His heart action was weak, rapid and irregular, and a diagnosis of myocarditis, probably due to beriberi, was made.

*Autopsy* by Dr. Whitmore three hours after death of the patient. The body is well developed and well nourished and, with the exceptions hereafter noted, the organs present no macroscopical alterations. Upon opening the abdomen, the liver and spleen are found to be moderately enlarged, the latter being somewhat adherent. The liver is not cirrhotic in appearance, but presents pale patches over its surface, and, more particularly, many whitish nodules varying in size up to the head of a pin, and situated under the capsule. On excising and crushing these nodules, oval eggs are found measuring approximately 70 by 40  $\mu$ . On section, many more nodules are seen scattered throughout the entire organ. The small intestines harbor a small number of hookworms; they present no gross changes, while the large intestine shows only one small area situated low down in the bowel, where the mucous membrane is swollen and injected. The bowel contents show ova similar to those in the liver, but these are few in number, and ova of uncinaria are also present.

*Histologic examination.*—Tissues were secured from the liver, kidneys, lungs and intestines. These were preserved in Kaiserling's solution and in formalin, imbedded in paraffin, sectioned and stained with hematoxylin and eosin and with Bismarck brown and eosin. A microscopical study of the liver shows the presence of ova either in groups or singly, usually occurring in the interlobular connective tissue (Pl. I, fig. 1), but also occasionally throughout the parenchyma, and in one instance an ovum is found apparently lodged in the intralobular vein. There is a considerable increase in the connective tissue around the lobules and encroaching upon them. The staining of the tissue is irregular, being quite faint in places.

The most striking feature is the presence of the miliary nodules noted above. (Pl. I, fig. 2.) These tubercular-like nodules are mentioned by Katsurada, but are said to occur rarely in the parenchyma. Our sections show them situated exclusively in the parenchyma occupying the place of a lobule or of two or more lobules fused together. The central area stains deepest, and is composed of an indefinite mass of nuclei, red blood cells and fibrin. It is quite sharply defined from the next zone which is made up of young connective tissue radiating toward the center. This zone gradually merges with a ring of still younger connective tissue belonging to the interlobular tissues. Some nodules have a small center and are evidently being gradually walled off and replaced by new connective tissue growth beginning at their peripheries. Throughout this connective tissue there is a new formation of bile channels, apparently an effort to repair the damage to the lobule. Ova are usually present in small numbers in these nodules. (Pl. I, fig. 3.)

Sections of the large intestine show the presence of ova in small numbers in the submucosa, accompanied by a moderate increase in the connective tissue. They occur in small groups outside the vessels close to the *muscularis mucosae*. Ova are also found in the mucosa lying close to the epithelial cells of the glands of Lieberkühn. The muscular layers are apparently unchanged. No ova are found in the small intestine nor in the other tissues. The ova in the walls of the intestine seem much more compressed and distorted than those in the liver. The vessels of the mesentery of the large intestine were carefully searched for the adult parasites, but without success.

Measurements were made of a number of the ova in the tissues, and they were found to average 62  $\mu$  in length by 39  $\mu$  in width, dimensions which are approximately those given by Stiles, Woolley, Katsurada and

Catto in their accounts of the ova of *Schistosomum japonicum*. They were studied in comparison with a section of the liver from Catto's case, which shows ova of a similar appearance.

### III. PATHOGENESIS OF THE CIRRHOSIS OF THE LIVER.

It is clearly evident that in this case the liver was the organ to bear the brunt of the infection, the invasion of the intestinal walls being of but secondary importance to the lesions in the liver. In this respect the findings here are in accord with those hitherto reported in cases of this malady. In the earliest Japanese writings on the disease, the latter is described as a peculiar cirrhosis of the liver due to a parasite, while Katsurada, in his original description, speaks of it as an affection of the liver both of man and of cats. In the case described by Catto, the extreme enlargement of the liver and spleen was noted during life, while at autopsy, although there were marked changes in the other organs, especially in the large intestine, the cirrhotic condition of the liver was perhaps the most striking feature. In Woolley's case, the first to be described in the Philippine Islands, the liver was smaller than normal and markedly cirrhotic. In both of these instances numerous ova were found in the perivascular tissues of the liver, where they apparently caused a marked hypertrophy of the connective tissue. In two of three cases reported by Dr. Logan in China, enlargement of the liver was a prominent feature of the malady while in all three, oedema of the legs and ascites were present, possibly due to hepatic diseases. This list includes all the reported cases that have come to our knowledge, and in practically all of them changes in the liver have been found either clinically or by post-mortem examination.

The pathogenesis of the cirrhosis in these cases is difficult to establish. A moderate increase in the interlobular tissues might be due to the presence alone of the ova, but how can we account for the destruction of whole lobules in the presence of but a very few ova? The anastomosis of the blood vessels within the lobule is so free that it is difficult to see how the ova, acting as emboli, could produce this result, but Katsurada, according to Stiles, believes this to be the explanation of the cirrhosis, although he speaks also of a toxin which he thinks is elaborated by the worm and which plays a part in producing the liver changes.

### IV. COMPARISON OF INFECTION WITH SCHISTOSOMUM JAPONICUM AND SCHISTOSOMUM HÆMATOBIMUM.

Let us contrast the pathology of the above case with that encountered in Bilharzia infections. Madden, in his excellent monograph on Bilharzia, devotes a score of pages to the pathologic anatomy of the intestinal and urinary tracts, and in four lines disposes of the liver with the statement, "Kartulis and Symmes have described a periportal cirrhosis as having occurred in this disease." Scheube says that the ova have been

found in the liver, with slight cirrhotic changes. Manson speaks of the occasional presence of small numbers of ova in the liver, but knows of no pathological change caused by their presence. Other writers on the subject are a unit in regarding the liver as a negligible factor in Bilharziosis.

The question immediately suggests itself, why, in Bilharzia disease, should the ova cause such profound changes in the intestines and bladder, to the practical exclusion of alterations in the liver, while, in a disease as closely allied as the one under discussion in our paper, the liver should be the chief site for the lodgement of the ova and its pathology the chief features of the malady?

Dr. Letulle has published an extremely interesting article<sup>3</sup> in which he worked out, with the most faithful attention to details, the histologic changes in a case of intestinal Bilharziosis, and from them drew some convincing conclusions. It is not our purpose to discuss the process of reasoning by which these conclusions were reached, and, therefore, we will give only his explanation of the local distribution of the ova and the resulting pathologic changes. According to his idea the pair of worms, with the female occupying the gynocophoric canal of the male, habitually inhabit the larger venous radicles of the portal system. When the time comes for the deposition of the ova, the worms, still together, migrate to the smaller veins until, having reached such a vessel of a caliber of about 1,000  $\mu$ , the male can go no further because of his size. The female then leaves the male and migrates as nearly as possible to the lumen of the intestine or bladder, that is, into the venules of the submucosa where the vessels are narrowed to 80 to 120  $\mu$ , and where she can go no farther. She takes position in one of these small veins, completely blocking it, and produces a stasis in the vessels ahead. She attaches herself by her suckers to the intima of the vessel and evacuates her ova into the distal portion of the vein. The pressure of the mass of ova, as well as that of the blood, enable their spines to pierce the walls of the vessels, and the whole mass is forced into the perivascular tissue so quickly, according to Letulle, that although he saw many masses just without the vessel, he did not find a single ovum within the lumen. The female having deposited her ova and waited a sufficient length of time for their migration, joins the male in the large vessels.

Let us apply these facts to *Schistosomum japonicum*. Here we have a similar pair of worms of the same relative size, although both are somewhat smaller than in the Bilharzia species. Although it is not proved that *Schistosomum japonicum* inhabits exclusively or even habitually the arterial side of the pelvic blood supply, Catto found worms in the arterioles in this location; and we have Manson as an authority for their

<sup>3</sup> Arch. de Parasit. (1905) 9, 329.

presence on the arterial side. Now let us conjecture that the female, leaving the male in the larger arteriole, migrates into a small vessel which she will just occlude. Attaching herself as in the case of *Bilharzia*, she deposits her ova, not into a venous radicle, but into the distal side of the arteriole where the ova will be aspirated onward, the more so as in this case they are not provided with spines. Finally they reach the intervening capillaries which have a caliber of perhaps 12 to 20  $\mu$ , while the ova which must pass, measure, on the average, 40  $\mu$ . If the pressure on the mass of ova is sufficiently great to force a portion of their numbers through the vessel wall, it is not unlikely that another part will be forced through a distended capillary, especially as under the latter circumstances they would be compelled to pass through a distance of no more than 0.5 millimeter before larger venous radicles would be reached, this distance being the average length of a capillary. Having successfully passed the capillaries, nothing would intervene until the liver was reached, where all but the exceptional ovum would lodge. The fact that these exceptions exist, as is proved by the occasional ovum found in the lungs, kidneys and elsewhere, strengthens the evidence of their passing through the capillaries of the pelvis. The marked difference in the pathology of the two diseases, bilharziosis and schistosomiasis, may therefore depend first, on the location of the parasites: the one in the venous and the other in the arterial side of the portal circulation; and, second, on the morphological difference in the ova.<sup>4</sup>

#### V. GEOGRAPHICAL LOCATION.

There is nothing in the history of the case we report that is of any assistance toward clearing up the mystery of the mode of infection, nor, on the other hand, anything inconsistent with the theory put forward by the Japanese physicians that the infection is acquired by contact with stagnant water containing the embryos of the parasite. From the relatively small number of ova present it is fair to infer that the infection we studied was of a comparatively recent origin, and that it was acquired after the patient joined the military service. The Scout companies in the Visayas have performed much active duty in the field during the past few years and probably have frequently found it necessary to wade stagnant pools similar to those described by Katsurada as being the habitat of the embryo of this parasite.

<sup>4</sup>Professor Akira Fujinami has recently published an article on *Schistosomum japonicum* in which he states that the usual habitat of the adult parasite is in the portal system, it having been found by him in the intestinal veins, the mesenteric veins, the branches of the portal vein within the liver, and in the splenic vein. It therefore appears as if the morphology of the ova, rather than the location of the adult parasite, is the chief factor in the distribution of the ova in the tissues of the body.

The most important fact in the history is the continuous residence of the patient in the Visayas and the practical certainty of his having acquired the infection in that part of the Philippine Archipelago.

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## ILLUSTRATIONS.

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### PLATE I.

- FIG. 1. Ova of *Schistosomum japonicum* in connective tissue of the liver.  $\times 380$ .  
2. Miliary nodule in the liver.  $\times 100$ .  
3. Nodule showing presence of ova.  $\times 8$ .



FIG. 1.

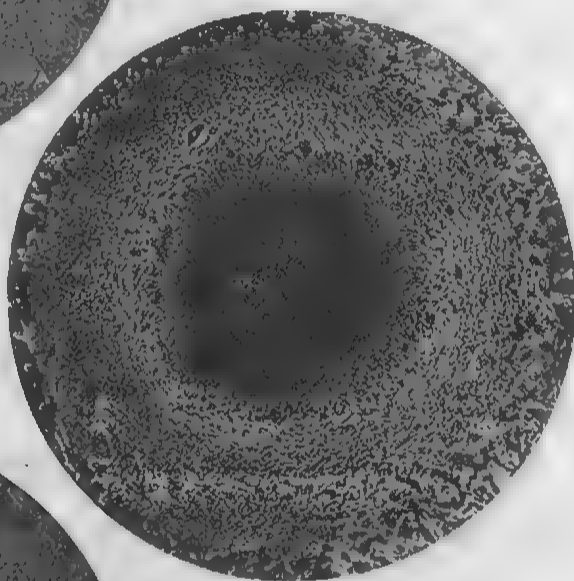


FIG. 2.

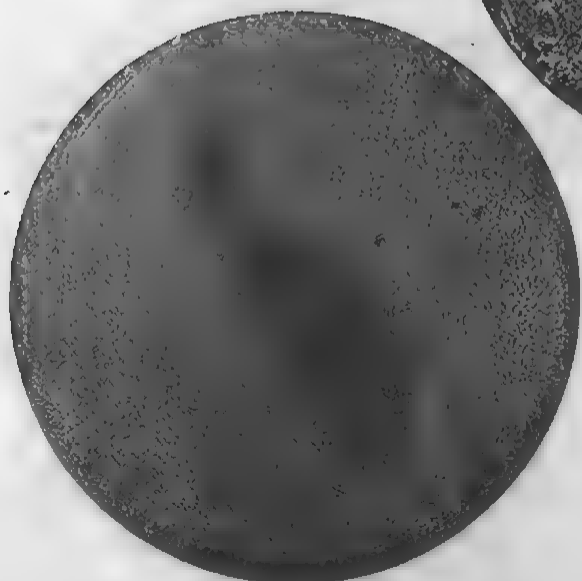


FIG. 3.

## THE DIAGNOSIS OF AFRICAN TICK FEVER FROM THE EXAMINATION OF THE BLOOD.

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The study of the various forms of relapsing fever has attracted considerable attention during the past four years. In 1904 P. Ross and Milne, working in Uganda,<sup>1</sup> were able to demonstrate that the disease heretofore known as tick fever and supposedly conveyed by the bite of a tick, was due to a *Spirochaeta* which was found in the circulating blood, though usually present here only in very small numbers. Although the disease termed tick fever had been recognized for a long period of time, and was mentioned by Livingstone in 1857,<sup>2</sup> its etiology had previously remained obscure.

In 1905 Dutton and Todd<sup>3</sup> in the Congo were able to confirm the observation of Ross and Milne, and to show that the parasite could pass into the egg and larva of the tick *Ornithodoros moubata* (Murray) and so confer infective power upon the mature form of the succeeding generation. They also frequently found the spirochaete to be very scanty in the circulating blood. R. Koch,<sup>4</sup> in his studies in Africa in 1905 and 1906 also concluded that the African recurrent fever was transmitted by the bite of the tick *Ornithodoros moubata*. He reported that the malady might be considered an African variety of relapsing fever, but not a distinct and different disease from the European one. He emphasized the fact that the parasites were not numerous in the peripheral blood. He believed that these organisms were usually a little longer than in the case of *Spirochaeta recurrentis* and that the febrile periods were shorter in the African than in the European variety, but that the two were otherwise similar.

Until the past year (1906) but one distinctive form of relapsing fever in man caused by spirochaete had been distinguished, although Manson<sup>5</sup> and later Sambon<sup>6</sup> had previously suggested that there might be several

<sup>1</sup> Brit. Med. Journ. (1904), 2, 1453.

<sup>2</sup> Mission. Travels and Research: J. Murray, London (1857), 1, 283, etc.

<sup>3</sup> Brit. Med. Journ. (1905), 2, Nov. 14, 1259. Mem. Liv. School Trop. Med. (1905), 17, 1.

<sup>4</sup> Deutsche Med. Wchnsch. (1905), 31, Part II (Nov. 23), 1865. Berl. klin. Wchnsch. (1906), 43, 185.

<sup>5</sup> Brit. Med. Journ. (1904), 1, 538.

<sup>6</sup> Brit. Med. Journ. (1905), 2, 126.

forms of this type of disease due to different species of spirochætæ, and Ross and Milne had stated that it was possible there might be more than one variety of tick fever.

In 1906, Novy and Knapp,<sup>7</sup> after a study of a case of relapsing fever in the United States, concluded that because of morphological characteristics which they were able to detect in stained specimens of the spirochætæ from their own case, and in those of African spirochætæ obtained by them from the Liverpool School of Tropical Medicine, relapsing fever and tick fever are distinct. They also based this claim upon the published experiments of Dutton and Todd and particularly of Breinl and Kinghorn,<sup>8</sup> who found that the spirochæta of the tick variety was frequently fatal to rats and mice and that in rats from three to four relapses occurred before death. Novy and Knapp found that in the case of the spirochæta, which they regarded as *Spirillum obermeieri*, the infection in rats was shorter and that no relapses occurred. They also believed that the diffuse flagella of the organism of tick fever as pictured by Zettnow<sup>9</sup> served as an additional "clenching" proof and effectually differentiated it from *Sp. obermeieri* which had, according to their observations, but a single terminal flagellum. However, according to later observers, Uhlenhuth and Haendel,<sup>10</sup> Novy was not working with *Spirochæta obermeieri*, but with another species, an American variety. Breinl and Kinghorn<sup>11</sup> also found that a monkey and several rats immunized against the American spirochæta (supposed to be identical with *Sp. obermeieri*) remained susceptible to the African species. They were also able to infect a horse, dogs, rabbits, guinea pigs and other animals with the tick-fever parasite. They therefore concluded that the two varieties, American and African relapsing fever, are distinct. Novy and Knapp proposed to differentiate the different species of spirochætæ by serum reactions, specific agglutinins and bacteriolysins, as well as by animal inoculations. Uhlenhuth and Haendel and Frankel,<sup>12</sup> during the present year, and very recently Manteufel,<sup>13</sup> by means of animal inoculations as well as by agglutinative and bacteriolytic reactions, have found that different results are obtained with the European, African and American spirochætæ, and they regard them as three distinct species. Schellack<sup>14</sup> has also very recently recounted the morphological differences in the European, American and African spirochætæ of the recurring fevers.

During a recent visit to the Institut für Schiffs- und Tropenkrankheiten in Hamburg, I had the opportunity, through the kindness of Professor Prowazek, of studying strains of spirochætæ obtained from America and from Africa, and since this time, in different countries, I have examined the other strains of spirochætæ already described in the literature. In the present paper I shall not consider particularly the work in regard to the differentiation of all the spirochætæ of the relapsing

<sup>7</sup> *J. Am. Med. Ass.* (1906), 46, 116. *J. Infect. Dis.* (1906), 3, 291.

<sup>8</sup> *Lancet* (1906), March 10, 668. *Mem. Liv. School Trop. Med.* 20, 61.

<sup>9</sup> *Ztschr. f. Hyg. u. Infektionskrankh.* (1906), 52, 539.

<sup>10</sup> *Arb. a. d. k. Gsndtsamte* (1907), 26, Heft I, 1.

<sup>11</sup> *Lancet* (1906), June 16, 1690. *Mem. Liv. School Trop. Med.* (1906), 20, 61, 69, and 21, 1.

<sup>12</sup> *Berl. klin. Wchnsch.* (1907), 44, 681.

<sup>13</sup> *Arb. a. d. k. Gsndtsamte* (1907), 27, Heft II, 327.

<sup>14</sup> *Arb. a. d. k. Gsndtsamte* (1907), 27, Heft II, 364.

fevers, but shall merely record the results of some experiments carried on in relation to the diagnosis and differentiation of the African tick variety of the disease. Ross and Milne,<sup>15</sup> in examining cases of spirillum fever in Uganda, Africa, found that the organism might be exceedingly rare in the blood, even when the examination was made at the height of the fever and from cases which from a clinical standpoint were well marked. Sometimes it was necessary to spend several hours before finding a single spirillum, and in some instances only two or three were found in the whole blood film. In one case of tick fever out of eight which were studied, about one spirillum was found in every thirty fields, in the other seven very few spirilla were present. These authors refer to the fact that Daniels examined a case of the disease in the second week with negative results. Dutton and Todd, R. Koch and Manson all agree that the parasites in tick fever are much more scanty than in European relapsing fever. I observed a patient in Africa who was in approximately the second week of fever, in whom no spirochætæ could be found in the circulating blood in a single, but careful and prolonged examination of the fresh film and of one stained preparation. However, a small amount of blood collected at the same time that the microscopic specimens were examined, was inoculated into a mouse and three days later spirochætæ were found in its blood. Therefore, it is clear that in some cases of tick fever, during its active periods, a diagnosis may not be arrived at from a study of the blood with reference alone to the presence of spirochætæ. Moreover, in both the European and African varieties of the disease, the parasites may be entirely absent from the blood during the relapses or in the later stages, and then even animal inoculations may fail as a means of diagnosis. It is also true in relation to the employment of animal inoculations as a means of diagnosis, white or gray mice, or white rats, the animals which are most valuable for use in this connection, are usually very scanty or impossible to obtain in most tropical or subtropical countries. I have recently been able to show that wild mice captured in these districts are not sufficiently susceptible to infection with the African species of spirochætæ to be of value for use in diagnostic purposes. In addition, neither of these means permits of a differentiation of the species of spirochætæ and of the separation of tick fever from the other forms of relapsing fever. Hence, other methods of diagnosis are desirable.

As long ago as 1896 and 1897 Gabritschewsky<sup>16</sup> and Loventhal<sup>17</sup> suggested and employed the serum for diagnostic purposes in cases of relapsing fever. They recommended that a drop of serum of the patient to be tested and which contained no visible spirochætæ be added to a drop

<sup>15</sup> *Loc. cit.*

<sup>16</sup> *Ann. Inst. Past.* (1896), 10, 630.

<sup>17</sup> *Deutsche med. Wochensh.* (1897), 23, 560.

of blood of a patient known to be suffering with relapsing fever and in whose circulation the parasite was present. The bactericidal action of the first serum was then observed under the microscope for various periods of time. Later Karlinski,<sup>18</sup> Routkewitsch,<sup>19</sup> Mielkich<sup>20</sup> and particularly Hodlmoser<sup>21</sup> also employed this method for diagnostic purposes in European relapsing fever, although not always with favorable results. Hodlmoser emphasized the fact that in the sero-diagnostic method of European relapsing fever, the most striking feature is the spirolytic action of the serum rather than the agglutinative one. While he believed that the reaction could not be obtained with absolute certainty in all cases of relapsing fever, it nevertheless constituted in many a valuable means of diagnosis. In all of these experiments the blood of another patient containing spirochætæ was employed in making the test of the suspected patient's serum. Hence, fresh cases of relapsing fever in human beings were always necessary in order that the test might be performed. It therefore naturally occurred to me that an examination of the blood serum in African tick-fever infections for specific agglutinins and bacteriolysins might sometimes prove of additional value in obtaining a diagnosis, the blood of animals infected with the spirochætæ instead of that of human beings being employed in testing the serum. However, I found that while sometimes by means of the agglutination or bacteriolytic reaction a satisfactory result might be obtained with an immune spirochætæ serum, nevertheless it soon became apparent that the reaction was frequently too uncertain and inconstant to be depended upon for diagnostic purposes. Moreover, it could not be considered to be of any practical use to the average physician.

There are many difficulties to be encountered in performing the agglutinative and spirolytic test with the spirochætæ of this group, and it is perhaps unnecessary to emphasize that the reaction can not be carried out with nearly the same facility as the agglutination reaction with immune sera and bacteria. Perhaps the greatest difficulty is experienced in securing the proper culture of the spirochætæ in the blood to be used in testing the agglutinative and bacteriolytic power of the serum of the affected patient. While, in general, it may be stated that the white mouse is the most suitable animal to employ and that the blood containing spirochætæ should be collected in citrate solution on the second or third day after infection, because the parasites are apt to be most numerous and most active at this period of time, nevertheless it frequently occurs

<sup>18</sup> *Wien. klin. Wochsch.* (1903), 16, 447. *Centrbl. f. Bakteriöl.* (1902), 1, 31, 566.

<sup>19</sup> *Baumg. Jahresb.* (1898), 14, 613. Original article in *Russisches archives d. Pathol. etc.* (1898), July 5.

<sup>20</sup> *Baumg. Jahresb.* (1900), 16, 434.

<sup>21</sup> *Wien. med. Wochsch.* (1904), 54, 2310. *Ztschr. f. Heilk. Abt. Intern. Med.* (1905), new series 8, 508.

that the blood of the animal when taken at these periods contains too few spirochætæ to render the test satisfactory or conclusive, and this may occur although the animal was previously inoculated with a large amount of blood richly infected with spirochætæ. In some instances the spirochætæ in the blood may appear to be ideal for the performance of the test, the parasites being numerous, active and not agglutinated, yet when they are added to a normal serum they may undergo spontaneous agglutination as marked as if an immune serum had been employed. Again, in some instances in the same period of time that they become agglutinated and clumped in the immune serum, they may undergo the same apparent process in their own serum, without the addition of that of the blood to be tested. The parasites at other times may appear to be very numerous in the blood at the time of the examination and in the few minutes required to bleed the animal they may apparently all disappear before anything is added to the blood. These phenomena may be understood at least partially when one considers that in the infected animal the agglutinins and spirolysins are being developed gradually with the development and increase in number of the spirochætæ, and hence in animals which show a very rich infection with spirochætæ, agglutinins and spirolysins are already present to a greater or less extent. Sometimes the withdrawal of the blood seems to be all that is necessary to stimulate the complements and antibodies to action and in other instances the additional amount of these corresponding substances, either present in the normal or immune serum, may be necessary to bring about the phenomenon of agglutination or of bacteriolysis. Sometimes it will be necessary to take the blood from several animals before one is found in which a satisfactory condition of the spirochætæ exists for the performance of the agglutinative or bacteriolytic test. Indeed, on some occasions it has taken me three or four days before satisfactory conditions for even the proper performance of these tests could be obtained. Obviously, the employment of the spirolytic test in the abdominal cavity of an animal presented even greater difficulties. It therefore seemed highly desirable that some other means be found that would serve as an aid in the diagnosis of the disease and in the differentiation of its different varieties, and I determined to see if the precipitin reaction might be employed for this purpose. Evidently if this reaction could be shown to be satisfactory for this purpose the diagnosis of this group of diseases would be much simplified and at once placed upon a practical basis.

As is well known, Kraus<sup>22</sup> in 1907 first showed the existence of specific precipitins for the albuminous bodies found in bacterial cultures. Later it was demonstrated that the reaction might be employed for the differentiation from one another of the vibrios of Finkler and Prior, Nasik, Denecke, and of Metchnikoff, and also for differentiating colon from paracolon bacilli. Wladimiroff<sup>23</sup>

<sup>22</sup> *Wien. klin. Wochensh.* (1897), 10, 736.

<sup>23</sup> *Kolle und Wassermann Handbuch d. pathogen Mikrorgan.* (1904), 4, 1055.



employed the reaction in the diagnosis of glanders, using a glycerine-free culture filtrate of *Bacillus mallei* added to the serum of the glandered horse. The employment of the reaction with sera prepared by injecting into one animal certain albuminous bodies of another one has also proved of great value for diagnostic purposes, and in some instances a very delicate test. Thus Wassermann and Uhlenhuth,<sup>21</sup> with proper immune sera, showed that a specific precipitin reaction might be obtained against the dissolved albuminous substances in human blood in the dilution of 1 to 50,000. The precipitins have been proved to be absolutely specific against those of unrelated species, although they sometimes react on closely related albumens. The reaction has also been employed for the differentiation of other microorganisms, including bovine and human strains of tubercle bacilli and even for the various species of trypanosomata, with varying results. Shortly after my experiments were begun with the precipitin test in the diagnosis of the spirochætæ of relapsing fever, the work of Fornet, Shoreschewsky, Eisczimmer and Rosenfeld,<sup>22</sup> on the subject of "Spezifische Niederschläge bei Lucas Tabes und Paralyse" appeared. These authors found that upon mixing the serum from acute cases of syphilis with that from cases of the same disease of long standing, with tabetic and paralytic symptoms, that a precipitin was obtained. They believed that in the more acute cases of syphilis, those in which spirochætæ were found to be present, the precipitinogen was present in the serum and that in the older cases of long standing the precipitin existed. They employed the ring test for these reactions, placing the heavier serum at the bottom of a small test tube and adding gradually the lighter serum in a layer on top. At the junction of the two sera in the case of a positive reaction, the precipitate appeared as a narrow band or ring. Still more recently Michaelis<sup>23</sup> has reported that he obtained a specific precipitin reaction with the blood sera in cases of syphilis, employing an extract of the liver as the solution containing the precipitinogen.

The experiments to be recorded here were conducted with two strains of spirochætæ, one obtained from Africa and the other from America. At first the precipitin reactions were carried on in small, conical reagent glasses by mixing the serum supposed to contain an excess of precipitinogen with the immune serum supposed to contain an excess of precipitin. The resulting mixture was then compared with one consisting of the first serum to which a normal serum had been added. After reading the article of Fornet and his colleagues, the reactions were carried on by superimposing one serum upon the other, as was suggested by these authors, the second serum being allowed to flow down the side of the reagent glass from a capillary pipette until a layer of equal thickness to that of the first below had been introduced. Care was taken to observe that the blood from which the serum was separated and used for the precipitin contained no spirochætæ which could be detected by microscopical examination, both before and at the time the blood was collected for the test, and that the blood from which the serum was separated for use as the precipitinogen contained numerous parasites.

<sup>21</sup> *Loc. cit.*, 594.

<sup>22</sup> *Deutsche med. Wchnsch.* (1907), 33, 1679.

<sup>23</sup> *Berl. klin. Wchnsch.* (1907), 44, 1477.

The blood serum tested for the precipitin was collected from animals which had received one, two and three separate infections of spirochætae respectively, and from which the spirochætae had disappeared so far as could be determined by microscopical examination.

Since it has been observed in the study of the precipitin reaction that the precipitin is sometimes soluble in an excess of precipitable substance, and that there must exist a certain quantitative relationship between the amount of precipitin and precipitable substances for the optimum reaction, many of these experiments were also performed in various dilutions of the sera. Finally, these same sera were examined for the presence of agglutinins, and in some instances for bacteriolysins.

The following series of experiments illustrates the value of the precipitin reaction for diagnostic purposes in this disease.

## EXPERIMENTS.

## SERIES NO. I.

*Mouse No. 1* inoculated on two different occasions with African *Spirochæta recurrentis*; the last inoculation ten days previously. Microscopic examination shows no spirochætae in the circulating blood.

*Mouse No. 2* inoculated on two previous occasions with the American spirochæta; the last inoculation twelve days previously. Microscopic examination of blood negative for spirochætae.

*Mouse No. 3* inoculated three days previously with the African spirochæta. Microscopic examination shows very few spirochætae present in the circulating blood.

*Mouse No. 4* inoculated three days previously with the American spirochæta. Microscopic examination shows very rich infection with spirochætae.

All four animals were bled to death; the blood placed on ice over night; the next morning it was centrifugated, the serum drawn off from the clot and recentrifugated in each instance. All sera were obtained clear. The following reactions were performed:

Conditions of reaction.		Precipitin reaction.
Serum of—	Plus serum of—	
Mouse 1 (immune to African S.)	Mouse 3 (infected with African spirochæta) ..	Negative.
Mouse 1 (immune to African S.)	Mouse 4 (infected with American spirochæta)	Slight clouding of the mixture of sera.
Mouse 2 (immune to American S.)	do .....	Negative.
Mouse 2 (immune to American S.)	Mouse 3 (infected with African spirochæta) ..	Do.
Normal mouse .....	do .....	Do.
Normal mouse .....	Mouse 4 (infected with American spirochæta) ..	Do.

<sup>22</sup> It was thought advisable to allow the blood containing the spirochætae to stand over night in order to aid in the breaking up of the spirochætae and thus favor the passing of the soluble albumens into the serum.

*Remarks.*—Only in one instance is there a suggestion of a reaction, and this is between the American spirochæta and the African immune serum. With the African spirochæta and the African immune serum there is no evidence of a reaction. However, since the parasites were very scanty in the serum containing African spirochætae, it is possible there was not sufficient precipitinogen present to give rise to a precipitate.

## SERIES NO. II.

*Experiments with the African strain.*—Rats numbered 1, 2 and 3 having had one inoculation of African spirochætae twelve days previously, were inoculated November 8 each with 0.25 cubic centimeter of mouse's blood, containing fairly numerous African spirochætae, diluted with saline solution. November 11, microscopical examination; no parasites were found in the blood of any of the rats. Evidently relatively immune to the infection.

Rats numbered 4, 5, 6 and 7 (all normal rats) were each infected on November 8 with 0.25 cubic centimeter of the same mouse's blood containing African spirochætae used to immunize rats numbered 1, 2 and 3. November 11 one rat, number 5, has succumbed. In numbers 4 and 6 a few spirochætae are present in the blood. In number 7 the parasites can not be found.

November 12 a blood examination of rats numbered 1 and 2 again shows no spirochætae to be present. The animals were bled to death, the blood put aside for one and one-half hours and then centrifugated and the serum drawn off. A blood examination of rats numbered 4, 6 and 7 shows in each instance fair numbers of spirochætae; more were found to be present than in the examination of November 11. Numbers 4 and 6 were also bled to death, the blood centrifugated, placed aside for a few hours and the serum drawn off.

*Experiments with the American strain.*—Mice numbered 8 to 14 have had one previous infection with American spirochætae ten days previously; they were reinoculated November 8, each with 0.125 cubic centimeter of mouse's blood, containing numerous American spirochætae, diluted with saline solution. November 11 an examination of the blood shows the absence of spirochætae in the circulating blood. The animals are evidently immune.

November 8, rats numbered 15 to 18, normal rats, each infected with 0.25 cubic centimeter of mouse's blood containing numerous American spirochætae. This same blood was used to immunize mice numbered 8 to 14.

November 11 all of these rats (numbered 15 to 18) are found to be infected with spirochætae, although only a few of the parasites are present in the circulating blood.

November 12 an examination of mice numbered 8 to 14 shows no spirochætae in the circulating blood. Numbers 8 to 12 were bled to death and serum collected. Rats numbered 15 to 18 were also examined; only one, number 15, shows a rather rich infection, while the others show very few parasites, although more are present than on November 11. Rat number 15 was bled to death and the serum collected.

The following precipitin reactions were performed with the sera of the above animals:

Conditions of reaction.		Precipitin reaction.
Serum of—	Plus serum of—	
Rat 1 (immune to African S).....	Rat 4 (infected with African S).....	Negative.
Rat 2 (immune to African S).....	Rat 6 (infected with African S).....	Do.
Rat 1 (immune to African S).....	Rat 15 (infected with American S).....	Do.
Rat 2 (immune to African S).....	do.....	Do.
Mice 8 to 10 (immune to American S).....	do.....	Do.
Mice 11 and 12 (immune to American S).....	do.....	Do.
Mice 8 to 10 (immune to American S).....	Rat 4 (infected with African S).....	Do.
Mice 11 and 12 (immune to American S).....	Rat 6 (infected with African S).....	Do.

*Remarks.*—There was no trace of a reaction in any of the tubes after two hours, after eighteen hours, or even after forty-eight hours.

November 13 another of the rats, number 17, infected with American spirochæta on November 8, shows numerous spirochæta in the circulating blood. The animal was bled to death. Some drops of the fresh blood were mixed with citrate solution; after fifteen minutes the parasites had disappeared and could no longer be found on microscopic examination. It seems probable that the blood was collected just before the crisis, that the parasites were about to undergo bacteriolysis, and that the withdrawal of the blood hastened this reaction. The remainder of the blood collected was centrifugated and the serum separated.

The following precipitin reactions were performed, the serum of rat number 17 being used for the precipitinogen.

Conditions of reaction.		Precipitin reaction.
Serum of—	Plus serum of—	
Rat 1 (immune to African S).....	Rat 17 (infected with American S).....	Negative.
Rat 2 (immune to African S).....	do.....	Do.
Mice 8 to 10 (immune to American S).....	do.....	Do.
Mice 11 and 12 (immune to American S).....	do.....	Do.

*Remark.*—No trace of a reaction occurred in any of the tubes after two and after twenty-four hours.

In order to be sure that antibodies were already present in the sera of animals numbered 1 and 2 and 8 to 12, attempts were made to test the agglutinative value of the sera with the blood of mice numbered 19 and 20, which had been infected two days previously with African spirochæta and with the blood of rat number 17, the blood of which showed a rich infection with American spirochæta. However, although the reactions were performed with the blood of mice numbered 19 and 20, there were too few parasites present to allow me to arrive at any

definite conclusions, and as has already been stated, the parasites disappeared from the blood of rat number 17 a few minutes after its withdrawal. As the examination of the blood of all the other infected animals on hand on this date showed none containing parasites in a satisfactory condition for the performance of the agglutination or bacteriolytic test, these reactions could not be performed satisfactorily.

#### SERIES NO. III.

*Experiments with the African spirochæta.*—Mice numbered 1 and 2 had been infected about one month before with the African spirochæta. A blood examination on November 8 showed no parasites to be present. The animals were bled to death and the serum separated.

Mice numbered 3 and 4 were infected with the African spirochæta on November 5. A blood examination on November 8 showed the parasites to be very numerous. The animals were bled and a small quantity of the blood mixed with citrate solution for agglutination reactions. The serum was separated from the remainder.

*Experiments with the American spirochæta.*—Mice numbered 5, 6 and 7 had been infected about one month before with the American spirochæta. A blood examination on November 8 showed no parasites. The animals were bled to death and the serum separated.

Mice numbered 8 and 9 were infected with American spirochæta on November 5. A blood examination on November 8 showed a fair number of parasites present. The animals were bled to death and a small quantity of the blood mixed with citrate solution for agglutinative reactions. The serum was separated from the remainder.

The following agglutination reactions were performed:

Conditions of reaction.		Agglutination.	
Serum of—	Plus citrated blood of—	1-5.	1-10.
Mice 1 and 2 (immune to African S).	Mice 3 and 4 (infected with African S).	Marked after 15 minutes.	Marked after 15 minutes.
Mice 1 and 2 (immune to African S).	Mice 8 and 9 (infected with American S).	No agglutination but too few parasites present for a decisive test.	
Mice 5, 6, 7 (immune to American S).	Mice 3 and 4 (infected with African S).	Negative after 15 minutes; after one-half hour moderate agglutination.	Practically no agglutination.
Mice 5, 6, 7 (immune to American S).	Mice 8 and 9 (infected with American S).	Parasites too scanty to judge definitely of reaction, few found scattered. Not agglutinated.	

The following precipitin reactions were performed with the same sera:

Conditions of reaction.		Precipitin reaction after 3 hours.
Sera of—	Plus sera of—	
Mice 1 and 2 (immune to African S) .....	Mice 3 and 4 (infected with African S) ..	Negative.
Mice 1 and 2 (immune to African S) .....	Mice 8 and 9 (infected with American S) ..	Do.
Mice 5, 6, 7 (immune to American S) .....	do .....	Do.
Mice 5, 6, 7 (immune to American S) .....	Mice 3 and 4 (infected with African S) ..	Do.

*Remarks.*—The precipitin experiments performed in duplicate and in dilutions of the different sera of 1 to 5 and 1 to 10 were all negative. However, it is to be noted that agglutinins had already developed in some of the sera.

On November 11 the following further agglutinative reactions were performed with the same sera of animals numbered 1 and 2, and 5, 6 and 7; the citrated blood of mice numbered 10 and 11, infected with spirochætae on November 8, being used to furnish the spirochætae which were numerous and very active at the time of the test:

Number.	Conditions of reaction.		Agglutination.
	Sera of—	Plus citrated blood of—	
I	Mice 1 and 2 (immune to African S).	Mouse 10 (infected with African S).	Positive good clumps and star forms in 5 to 10 minutes in dilutions of 1-10 and 1-20. Parasites have lost almost entirely their motility.
II	Mice 5, 6, 7 (immune to American S).	do	Negative. Parasites retain their motility and remain singly. No clumps or agglutination in dilutions of 1-5, 1-10.
III	Mice 5, 6, 7 (immune to American S).	Mouse 11 (infected with American S).	Positive. Very large clumps and balls of organisms in 5 minutes. Marked reactions in dilutions of 1-10 and 1-20.
IV	Mice 1 and 2 (immune to African S).	do	Negative. Organisms remain single even in dilutions 1-2 and 1-10; also still motile.

*Remarks.*—The above reactions were observed in moist preparations and were confirmed also by stained ones. In experiments I and III, in the dilution 1 to 2, the agglutination was not so visibly marked because of the spirolytic action of the sera on the spirochætae.

#### SERIES NO. IV.

*Experiments with the African spirochæta.*—November 15, rat number 1 which had received two previous injections with African spirochætae on October 4 and November 8 was again inoculated November 15 with blood containing numerous African spirochætae.

Rat number 2, which had been given one previous injection of the African spirochæta on November 8, was again inoculated November 15 in the same manner as rat number 1.

Rat number 3, which had not been previously injected with spirochætae, was also inoculated on November 15 in the same manner as rats numbered 1 and 2.

*Experiments with the American spirochæta.*—Rat number 4, which had received two previous injections with American spirochætae on October 4 and November 8, was again inoculated on November 15 with blood containing numerous American spirochætae.

Rat number 5, which had been given one previous injection with the American spirochæta on November 8, was again inoculated on November 15 in the same manner as rat number 4.

Rat number 6, which had not previously been inoculated with spirochætae, was also injected on November 15 in the same manner as rat number 4.

On November 17 a blood examination of all the animals was made. In rats numbered 1 and 4 no parasites whatever were found; in rats numbered 2 and 3 very few parasites were seen; in rats numbered 5 and 6 a moderate number of parasites were encountered. On November 18 no parasites were found in rat number 2 but in rat number 3 they had increased in number; in rat number 5 they were still present.

November 21, rat number 7, a normal rat, was injected with African spirochaetae and rat number 8, a normal rat, with American spirochaetae. On November 23 microscopical examination showed rats numbered 1 to 6 all to be free from parasites; rats numbered 7 and 8 each showed moderate infections with spirochaetae. The animals were all bled to death and the serum separated.

The following precipitin reactions were performed:

Conditions of reaction.		Precipitin reaction.
Serum of—	Plus serum of—	
Rat 1 (immune to African S) .....	Rat 7 (infected with African S) .....	Negative.
Rat 2 (immune to African S) .....	Rat 7 (infected with African S) .....	Do.
Rat 3 (immune to African S) .....	Rat 7 (infected with African S) .....	Do.
Rat 4 (immune to American S) .....	Rat 8 (infected with American S) .....	Do.
Rat 5 (immune to American S) .....	Rat 8 (infected with American S) .....	Do.
Rat 6 (immune to American S) .....	Rat 8 (infected with American S) .....	Do.
Rat 1 (immune to African S) .....	Rat 7 (infected with African S) .....	Do.

The following agglutination reactions were performed:

Conditions of reaction.		Agglutination, dilutions 1 to 10
Serum of—	Plus citrated blood of—	
Rat 1 (immune to African S) .....	Rat 7 (infected with African S) .....	Strong reaction.
Rat 1 (immune to African S) .....	Rat 8 (infected with American S) .....	Negative.
Rat 2 (immune to African S) .....	Rat 7 (infected with African S) .....	Strong reaction.
Rat 5 (immune to American S) .....	Rat 7 (infected with African S) .....	Negative.
Rat 5 (immune to American S) .....	Rat 8 (infected with American S) .....	Positive reaction.
Rat 6 (immune to American S) .....	Rat 8 (infected with American S) .....	Negative.

The above-described experiments demonstrate that the precipitin reaction in the manner employed is of no value for the purpose either of the differentiation of the spirochaetae of relapsing fever or for the diagnosis of the infection. It would appear from the series of experiments numbered 3 and 4, that during immunization with these spirochaetae, as in some bacterial infections, the agglutinins and bacteriolysins become developed in demonstrable quantities more quickly than the precipitins. It is very probable that an animal might be sufficiently highly immunized so that a precipitin test for these spirochaetae could eventually be obtained; but the above experiments conclusively demonstrate that this test is not a practical one as a means of diagnosis of the infection.

It may be stated in relation to the employment of the agglutinative test for this purpose, that, as has already been pointed out, owing to the difficulties of technique in performing the reaction and to the fact that in tick fever infections the agglutinins sometimes do not become developed until after several relapses or reinfections with the spirochætæ have occurred (a fact to which Mantoufel<sup>28</sup> recently called attention for infections with *Spirochæta obermeieri*) the agglutinative reaction even in low dilutions also does not constitute a satisfactory means of diagnosis.<sup>29</sup>

For the present, the most efficacious methods at our disposal are the microscopic examination of the peripheral blood and of that obtained by puncture of the liver and spleen, both in fresh and in stained preparations, and by animal inoculations with the blood when suitable species are at hand for this purpose. Usually, a marked polymorphonuclear leucocytosis occurs, frequently before the crisis, and it usually persists for a day or two after it. At the latter time, an increase of the large mononuclear cells may be encountered. It should be remembered that even in cases well marked from a clinical standpoint, the microscopic specimens of the centrifugated blood may be examined an hour or two before a single parasite is finally discovered. If the parasites are not found by the examination of the blood, inoculations of white mice, white rats or monkeys with the blood of the suspected patient should be carried out if practicable. If the spirochætæ develop in the blood of the animal, they may if it is thought desirable be differentiated by means of specific agglutinating sera. Clinically, it is sometimes quite impossible to distinguish African tick fever from several other febrile infections.

I have seen in a hospital at one time as many as five cases diagnosed as spirochætal fever infections by a competent physician, thoroughly familiar with the clinical picture of relapsing fever and accustomed to seeing numerous cases of this disease. I was unable to find a single spirochæta in the blood of any of these patients.

Theoretically, it is very easy to distinguish tick fever from typhus fever, malaria, trypanosomiasis and *Kala-azar* by the blood changes. In practice, this is at times most difficult, and the individual case may require considerable study before a correct diagnosis can be made.

In conclusion, I wish to express my thanks to Professor Nocht, Professor Fullerborne, Professor Geimsa and Professor Prowazek, for many courtesies extended to me during my stay at the Institut für Schiffs- und Tropen-Krankheiten, where most of the laboratory experiments described in this paper were performed.

<sup>28</sup> Loc. cit.

<sup>29</sup> No attempt was made to employ the reaction of the deflection of the complement for diagnostic purposes in these spirochætæ infections, for the reason that it appears that the definite value of this reaction has not as yet been entirely determined for bacterial infections.



## OBSTETRICS IN THE PHILIPPINE ISLANDS.<sup>1</sup>

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### INTRODUCTION.

More than two years ago, in a lecture which I gave in the *Liceo de Manila*, by request of the *Asociación Feminista Filipina*, I had an opportunity to express my personal opinions on the interesting problem of infant mortality in Manila and at the same time to propose means for ameliorating this condition. I believed the most efficacious measure, along with popular education, to be the organization of a good service of midwives, with a lying-in dispensary to which the poor women of this city could go for assistance. In this manner we would remedy the necessity which compels women, neglected by fortune, to give birth to their children in miserable habitations lacking every hygienic facility and to place their lives and those of their new-born infants at the mercy of ignorant midwives, audacious in the abuse of obstetrical practice. It is necessary to establish a school for midwives who, when sufficiently instructed, would be excellent disseminators of the teachings derived from the practice of modern obstetrics.

The suggestion then made did not fall on barren soil, for the Philippine Commission, at the instigation of Dean C. Worcester, Secretary of the Interior, appropriated the funds necessary for the building in Manila, within a short time, of a pavilion hospital planned according to modern standards. One of these pavilions will constitute the beginning of the future lying-in hospital of Manila.

However, we are confronted by another question of equal importance. When the obstetrical pavilion is erected, can we count on the women of the lower classes, who form the majority of the population of these Islands, attending this new clinic and renouncing once for all the irrational practices of ignorant midwives and illegal practitioners? Before we can respond in the affirmative, it will be necessary for the Philippine Medical School and the Bureau of Health to agree to lead

<sup>1</sup> Read at the Fifth Annual Meeting of the Philippine Islands Medical Association, Manila, February 29, 1908.

and direct the education of these ignorant women into new channels, overthrowing routine customs and traditional means, many of which I shall briefly discuss in this analytical study of obstetrics in the Philippines.

#### EARLY SUPERSTITIONS.

During many centuries the mission of assisting in childbirth was confined exclusively to midwives, who were the oldest women of the community in which they resided and who, taught by their own personal experience, advised and aided the young and inexperienced. A certain number of precepts acquired by experience and observation, and a still larger number of individual practices and superstitions, represented the whole fund of knowledge employed in difficult cases. These midwives, who in primitive times existed in all countries, are still known in the Philippines by the name of *hilot*, a Tagalog word which has come down to us through many generations, in the same manner as the term *salag*, by which is known the person who assists the *hilot* in her empirical manipulations.

The conjunction of the moon, the appearance of comets, the flow and ebb of the tides, the direction of the winds and the influence of heat and cold were, for the *hilot* and *salags*, the etiologic agents which decided the development of pregnancy, or the evolution and progress of childbirth.

In view of such prejudices, it is not surprising that even in the most aggravated cases of dystocia, the unfortunate patient was abandoned to the sole efforts of nature, any rational intervention for saving her from certain death being absolutely unknown. Failure was attributed by the midwife to the fatal influence of the *asuang*, a malignant spirit which, according to the common people, lies in wait for pregnant women and, at the moment of labor, penetrates into the uterus to devour the foetus; just as another spirit called *patianac*, in the shape of a strange animal, introduces itself into the genitals of pregnant women in order to devour the product of conception. The influence of the *patianac* was to the midwife the logical explanation of the pathologic phenomena of pregnancy, which we now know as abortion, expulsion of a macerated foetus, uterine mole, *placenta prævia*, etc. In my opinion, these superstitions have their origin in the ancient beliefs of paganism predominating in the Philippine Islands before the arrival of the Spaniards, and they gained such a hold on the minds of the people that they are still preserved latent in some parts of the Archipelago, and have on some occasions given rise to barbarous practices and manipulations which are an outrage to civilization and which have cost the lives of many women in childbirth.

While I was an interne in the San Juan de Dios Hospital in the year 1889, I performed an autopsy on a poor woman who had died in the district of Tondo because a quack had barbarously beaten her with the

tail of a sting-ray. This woman, after a normal delivery, had contracted puerpal fever, and the violent chills which seized her were attributed by the quack to the presence of the *asuang*, which needed to be driven out of her by a severe whipping with some bruising instrument which, like the tail of the sting-ray, had the medicinal virtue of expelling all malignant spirits.

#### INFLUENCE OF THE MISSIONARIES.

At a later period, bearers of a new civilization arrived on these shores in the shape of the Spanish missionaries or friars. These representatives of the church spread throughout the villages of the Philippines and there they organized parishes. These holy men, ministers of a religion which is all peace and charity, could not long remain indifferent to the ailments of the body, and in the same manner as that in which they ministered to the afflictions of the soul, the woman in the throes of childbirth was also made the object of their solicitous care.

In order to give a slight idea of remedies which were used by the friars in these early days, I will here transcribe a curious chapter from the work of Father Pablo Clain, S. J., entitled "Easy Remedies for Various Diseases." The work was published in Manila in the year 1710, being practically two centuries old. The chapter mentioned, which is entitled "Parturition, How to Facilitate it," reads, literally translated, as follows:

"Cause the woman about to give birth to sneeze, by blowing into her nostrils some of the powder known as *Verbo apoplegia*, or mustard seed, and white pepper. Give her a spoonful of mass wine from time to time, or give her to drink, in tepid water, the balls of hair formed on deer or hogs (weight of nine or ten grains of pepper).

"As to the exterior, the midwife should frequently anoint the abdomen with tepid coconut oil, mixed with *escobilla juice*\* (*Sida carpinifolia* L.).

"Apply to the abdomen fomentations of a decoction of emollient herbs, such as *escobilla*, mallows, castiogan root (*Hibiscus abelmoschus* L.), *camantigue* leaves (*Impatiens balsamina* L.) and costmary (*Tanacetum balsamita* L.). Give her acrid and irritating injections. Some praise the gall of a black hen applied to the navel; others mouse excrements dissolved in tepid wine or tepid water given to drink (as high as six grains). A *duferro*\* stone should be tied to the thighs (or applied to the lower parts); but it should be removed immediately after the placenta has been expelled. A loadstone tied to the thigh, on the inner side, is likewise efficacious. If the new-born infant is weak, strengthen it by giving the mother a swallow or spoonful of tepid Castile wine, and externally, by placing on her abdomen a piece of toasted bread, sprinkled with hot mass wine and powdered cloves, cinnamon and nutmeg. If the child begins to emerge in an unfavorable manner, such as presenting first an arm or a foot,

\* The scientific names of the plants mentioned have been supplied by Dr. Leon Guerrero and by Mr. Merrill, Bureau of Science.

\* A translation of this word can not be supplied.

or in some other manner, the midwife must push it back inside of the mother, who must then lie on her back, with the head low and the nates raised, and after having put back the arm or foot which the child presented, the midwife must make it retrocede by gently pressing the abdomen of the pregnant woman upwards and towards the epigastric region, or the breast, and after the child is again within, she must manipulate it so that it will emerge in due form; the midwife endeavoring, using her hands, to make the child turn its face towards the back of its mother, and then by raising its nates and legs to the navel of the mother, to have it emerge in the proper manner.

"The common people use the following remedies: They make the parturient drink some of the milk of a woman nursing a child, or make her suck the nipples of such a woman; they cautiously apply to her body a snake skin shed by a snake, but remove it as soon as she has been delivered, because otherwise her entrails might come out. On the groins they put bruised *salibutbut* (*Taberna-montana Pandacqui* Poir.), warming it in hot ashes. The parturient is made to drink costmary juice in strong wine. She is given mint, bruised and mixed with water and honey, and forced to drink a decoction of *raiz oriental* (*Andropogon nardus* L.), *palasan* (*Calamus albus* Pers.) and panara plantain in water, as well as to drink bezoar taken from a deer or wild hog, burned on a potsherd and dissolved in a little wine or water. If the patient has any strength left, she is made to drink dog urine, or horse or cow excrements, three *reules* weight, dried, crushed and mixed with water or wine; this is also useful for ejecting a dead infant. She must hold a jasper stone in her hand. She is given sweet-basil juice (*Ocimum basilicum* Linn.) to drink."

However ridiculous these prescriptions may seem, the fact remains that they were faithfully observed and carried out in the treatment of many parturients, for the reason that they had come from the authoritative lips of a missionary priest, compelled by the force of circumstances to serve as physician as well. It was for good reasons that the Reverend Father Gregorio Sanz, of the Barefooted Order of Saint Augustine, writes as follows in his treatise on "Sacred Embryology" (p. 39), edited in Manila in the year 1856:

"In the Philippine Islands, where, in a way it may be said that outside of the capitals there is no physician but Providence, nothing was more common than to see the curates practice medicine among the natives of their parishes, whether the latter were men or women."

On pages 167 and 168 he adds the following words:

"The number of midwives in a parish having been ascertained, it is advisable to communicate to them individually the instructions which we give hereinafter, if they have not already received them; it is of the greatest importance to have them well instructed in this respect and for this purpose it is very advisable, in view of the facility with which these good people forget what has been taught them, especially if it be something that they have to practice only a few times, that every year after their first instruction, at the time of the examination in the catechism for the perfection of the parish, they be reexamined in everything that was taught them upon their admission into the profession of midwifery. If, though this is hardly to be expected, the midwives should object and refuse to receive instruction from their curates on this subject, it will become necessary to notify the civil authorities, in order that they may be

suspended from their profession and to inform the people of this fact in the sermon on the following Sunday."

These words show that in each parish the missionary priests exercised a certain control over a given number of midwives who received direct instructions from them. These instructions, in a special manner, referred to everything relating to proper baptism which, in cases of necessity, was administered to the child either within or without the mother's womb; but they also extensively entered into the manner of attending parturients. A proof of this is found in the following paragraph taken from the above-mentioned work of Father Gregorio Sanz, relative to the treatment of abortions:

"The first and most important thing is to advise the patient to remain in a horizontal position and to preserve absolute repose of body and mind; the second is to bleed the arm if the woman is robust, and if she is weak or nervous, to apply ten or twelve leeches or cupping-glasses to the breasts, these being the organs best indicated at this epoch; the blood-letting and likewise the application of leeches should be employed only when recommended by a medical person; at the same time a lemonade of cream of tartar, with sugar and small quantity of saltpeter, should be administered and the loins and abdomen should be gently rubbed with hot essence of mastic.

"If the woman is in convulsions, or if she is nervous and suffers very intense pain, then she must be given an antispasmodic potion composed of one ounce of almond oil, another of simple sirup, and, one grain of extract of henbane, of which one spoonful must be taken every half hour; at the same time the abdomen should be rubbed with a mixture of one ounce of henbane and one drachm of tincture of opium. Experience has demonstrated that in the majority of cases simple means are sufficient to check abortion at the outset, but as they are not all within the reach of the native midwives, and it is not easy for all to secure them, we shall indicate another remedy which is simpler, but assuredly not so efficacious.

"As soon as the pregnant woman feels the symptoms which we have indicated above she must remain very quiet, speak very little and keep to her bed for several days. Cupping-glasses may be applied to her arms and she may be given copious drafts of common water prepared in this manner: Two ounces of unhusked rice are boiled in half a ganta (1.5 liters) of water until the grains burst open; then the water is strained and two spoonfuls of lemon juice are added.

"She must abstain from eating meat, chicken, eggs and fish; her food should consist of rice broth or *paspas* (stewed rice and meat), of little substance if the patient is robust or sanguine. She may also be given a light enema of a decoction of mallow, with the yolk of an egg; but this is only in cases where the evacuations are accompanied by tenemus, or where the bowels have not moved for many days."

The same author, who is more modern than Father Clain and who seems to be inclined toward surgery, in an address to his colleagues, the parish priests, wrote the following in connection with the Cæsarian section performed after the death of the mother:

"Every curate should secure the proper instrument, which is none other than a convex bistoury, the price of which is only one peso in Manila. Surgeons

usually employ another bistoury with a blunt point, but we believe that this can be replaced by putting a small ball of wax on the point of the convex bistoury; and it is my opinion that in practice it is sufficient to cut the skin and the cellular tissue with a well-sharpened knife, reserving the bistoury with the ball of wax for the section of the peritoneum and the womb. If a razor is used, the handle should be firm and strong."

Judging from these statements, it appears that the medico-social influence of the missionary friars in the Philippines has been exceedingly important, especially in the field of obstetrics, and it is believed that with their evangelic advice, these priests dissipated the innumerable pagan superstitions relating to parturition, but, on the other hand, they sanctioned the use of many remedies utterly in conflict with common sense, some of which are to-day used by the lower classes. All of this is very excusable in these men, who were as full of the best desires and of love for their fellow-men as they were lacking in obstetrical knowledge. It is therefore not surprising that one still hears at the present time of some parturient to whom repulsive substances, such as dog urine, or mouse, horse or cow excrement have been administered.

Dr. Benito Valdez, of the faculty of the University of Santo Tomas, Manila, has recently told me of a parturient to whom a decoction of horse excrement was administered in order to facilitate labor, whereupon tetanus set in and the woman died. According to my informant, this case happened in Manila, approximately two years ago.

There are women who palliate the sufferings of childbirth by applying to the abdomen scapularies, images, medals, or to the feet, hands or other portions of the body relics of some famous saint venerated in the churches, or who drink, instead of urine or excrements, the miraculous water from Lourdes, accredited among pious people as an excellent medicine for facilitating parturition.

#### INFLUENCE OF THE CHINESE.

A very important factor which should be taken into consideration in this analytical study is the geographical proximity of the Celestial Empire to the Philippine Islands. Thousands of Chinese immigrants have invaded even the most remote parts of this Archipelago. One of the consequences of this immigration has been the introduction into this country of many superstitions originating in China which have become general among the Filipinos, and which have been strengthened by the arrival here of several Chinese physicians who practiced medicine among the natives according to Chinese usage. These so-called doctors acquired such influence that it is not an exaggeration to state that their queer therapeutic theories and practices are still followed by a portion of the population of the Philippine Islands.

While I was municipal physician in Carigara, Leyte, in the year

1894, I noticed that some of the inhabitants when ill preferred to call quacks who treated diseases according to Chinese methods and who used Chinese drugs. The latter were, at least at that time, freely sold in public establishments. There are to-day in Manila old people who remember with pleasure the Chinamen who practiced medicine and acquired fame and popularity in this city even among families of the best social standing and position.

It goes without saying that the ideas originating in China necessarily influenced Philippine obstetrics, the result being that in regard to parturition, the exotic superstitions of the Asiatics were added to the autochthonous superstitions of the Malay race. It would be curious, were it possible, to make a comparative study of obstetrics in the Philippine Islands and in China and to ascertain the mutual relationship which must exist between the two. Historical documents which might shed light upon this labyrinthic subject are, of course, lacking, but my own experience and the descriptions which I have secured from authentic sources, warrants my giving some personal information on the subject of certain Philippine superstitions of Chinese origin. What I have learned is as follows:

When a woman has on the palm of the hand a transverse line completely crossing it, it is a sign that she will have difficult births and it is necessary that at the moment of parturition the line mentioned be covered with a handkerchief. Dr. Castaneda, extern in obstetrics in the Philippine Medical School, recently saw a woman in the district of Sampaloc who was about to give birth to a child, and noticed that she had on each hand a silk handkerchief covering the lines on the palms.

Certain bricks of cylindrical form (*lario*) are manufactured in this country especially for parturients. They are well heated and then applied to the abdomen of the patient for the purpose of expelling from the womb wind and cold, two atmospheric agents which, according to Chinese tradition, are mortal enemies of the parturient.

The patient is never given chicken broth, for as the chicken is winged and flies, it carries with it much wind which it might transmit to the patient and thus injure her.

Women who are menstruating are prohibited from entering the lying-in room, because the effluvia of the former might be transmitted to the patient and give her fever or cause some other complication.

In cases of difficult parturition, the husband steps over the patient two or three times in order to cause delivery; and if this should not be sufficient, a pair of drawers which has been worn by the husband is tied to the woman's hair so that the smell of his father may cause the fetus to emerge at once.

Where swooning occurs, and especially where there is hemorrhage, the hair is bound in a tight knot, and the patient is not permitted to sit down, this to prevent the spirit from escaping from the body. A colleague told me of a terrible case resulting from this last superstition and witnessed by him in the Province of Ambos Camarines a few years ago. The wife of a Chinaman had a post-partum hemorrhage, caused by the retention of the placenta, and in order to stop the hemorrhage, either the Chinaman himself or the midwife, or both, had the

patient's coil of hair drawn very tight and by means of it they hung her from one of the beams of the house. The woman died in horrible convulsions while thus suspended.

In China the umbilical cord is not cut until the placenta has been expelled, for fear that the latter might rise, envelop the heart and kill the patient. Many Filipino midwives, influenced perhaps by this superstition, do not cut the umbilical cord until the placenta has been delivered, leaving the child sometimes for hours between the mother's thighs, covered with the sebaceous matter, meconium, amniotic fluid, blood and faeces. The placenta is creinated and then administered to the patient. The umbilical cord is burned, the ashes to be used as a remedy for stomach ache in children.

In China, when the parturient is in a very serious condition due to hæmorrhage, a chicken is killed, cut open and applied to the patient's breast to give her life. I have seen this done in the town of Ormoc, Leyte, when I was municipal physician in that settlement.

If the fœtus has coils of the cord around the neck, superstition has it that the boy will become a great man, as this condition recalls the Chinese mandarins and great dignataries who have bands covered with symbolic ornamental dragons wrapped around their bodies.

#### MODERN ADVANCES IN THE PHILIPPINES.

I wish here to render a tribute of consideration and affection to our colleagues who preceded us in the practice of medicine in these Islands and who planted in them the first milestones of rational obstetrics, according to the knowledge of that epoch. I do not allude particularly to the Spanish physicians, called *fisicos*, who, together with the troops and missions from Spain, landed each year from the famous Acapulco galleons, nor to those who came to this country between the years 1764 and 1869 with the expeditions organized at the port of Cadiz, sailing for Manila, by way of the Cape of Good Hope. These men formed such a small minority and had such scanty knowledge of obstetrics that their influence may well be disregarded in the evolution of this important branch of medicine in the Philippine Islands.

I wish to speak of the foreign, Spanish and Filipino physicians who, beginning in the years 1870, established themselves in Manila and the provincial capitals, shedding the first rays of the light of medical science on the chaotic state of affairs then prevailing. Among these pioneers of happy memory, I make special mention of the Englishmen Fullerton and the Burke brothers, the Germans Neizen and Koeniger, the Frenchman Permantier, the Portuguese Silva Magalhaes, the Spaniards Ginard, Marti, Meynet, Nalda, Pina, Torrejon, Sacristan, Mallen, Farinos and others who practiced medicine in this country. They are all deserving of gratitude and praise, because they contributed their grain of sand to the erection of the scientific edifice of obstetrics in the Philippine Islands.

The coöperation of Filipino physicians in the scientific labor already initiated was not long wanting after the creation in this capital of the faculty of medicine of the University of Santo Tomas. Beginning with



the year 1867, diplomas to licentiates in medicine and surgery were issued every year to young men who scattered throughout the Archipelago to practice medicine, either as private physicians or in some public capacity under the former Spanish Government. Although, so far as parturition was concerned, it must be admitted that the clinical education given in the lecture rooms of the university was exceedingly deficient because of lack of a practical foundation, yet it is no more than just to acknowledge that, thanks to spontaneous efforts and extensive personal experience, many of the native physicians became expert obstetricians and contributed materially to the advancement of this branch of medical knowledge in the Philippines.

Prominent among these men is the figure of Dr. Felipe Zamora, who for many years and until the close of Spanish rule, was the best obstetrician of Manila and the adjacent provinces. More recently, excellent obstetricians have developed in the persons of Drs. Pablo Nalda and Manuel Madrigal, both deceased, and among our own contemporaries.

Another event connected with the history of obstetrics in the Philippine Islands was the establishment in 1879 of a school of midwives annexed to the University of Santo Tomas. The course consisted of four semesters. Fifty-six of the one hundred and thirteen pupils who were matriculated received the degree of midwife. The school suspended operations in the month of March, 1903. Nine years after its creation, by virtue of a royal order of February 28, 1888, the service of official midwives who might render gratuitous service to poor parturients was established for Manila and the provinces, but nearly all the provincial positions remained vacant, probably because of the lack of competent, qualified persons. There followed the establishment of the *inspección general de beneficencia y sanidad*, by virtue of the royal order of September 10, 1888, to replace the old *subdelegación de medicina y farmacia*, which had existed since the year 1862. Later, there was founded the service of official physicians (*médicos titulares*) for the Archipelago, the latter being charged with the obligatory and gratuitous attendance of poor parturients within the municipal limits of Manila.

American sovereignty came in the year 1898 to replace that of Spain in the government and administration of these Islands, and after civil government had been established, the Board of Health was created in October, 1901. In December of the same year, the Board of Medical Examiners was constituted, charged with qualifying physicians, practitioners of medicine and midwives who wished to follow their profession in the Archipelago. Of the latter, thirty three were registered, certainly a very insignificant number for the entire Philippine population. Thirty-one of these were from Manila, one from Iloilo, and one from Ilocos Sur, there being none from the other provinces. Eight of these thirty-three qualified midwives were appointed municipal midwives, to render,

in conjunction with the municipal physicians, gratuitous services to parturients of the poor classes in the suburbs of Manila.

The Philippine Medical School was established by act of the Philippine Commission, December 1, 1905. It began operations July 1, 1907, and the chair of obstetrics was organized with its clinic in St. Paul's Hospital. Here several beds were reserved for poor parturients of this city. Similar action was taken by the San Juan de Dios Hospital, in consequence of the adoption of a new curriculum by the medical department of the Santo Tomas University.

#### ADVANCES IN THE USE OF INSTRUMENTS.

In the last two decades many obstetrical operations have been performed in the Philippines, such as the application of the forceps in its several varieties, versions by external, internal and mixed manipulation, the Cæsarian section on living patients, embryotomy, basiotripsy, provocation of premature labor, curettage, and perineorrhaphia of all kinds, with the exception of symphysiotomy and pubiotomy.

#### CONCLUSIONS.

It has clearly been demonstrated that in the Philippine Islands work has been going on for some time which tends to lead obstetrics into modern channels and to eradicate from the minds of the people the charlatanism, superstitions and irrational practices predominating in this branch of medicine. What has been the result of this scientific evolution? That it has been efficacious and useful to a large number of women belonging to the cultured families of this country who have at least realized that for confinements a physician should be called, is undisputed; but it has been negative in regard to the nameless mass of parturients of the lower classes who are completely given over to the illegal practitioners and midwives, with great danger to their own lives and to those of their new-born babes.

The services of a physician are, as a rule, dispensed with among the people of this stratum of society, even in the most serious cases of dystocia, and the patient is left to her fate. If a physician is sent for, he is almost always called after the moment has passed when a simple intervention on his part might have prevented the death of the mother, or of the child, or of both.

A few instances might be cited in this connection: Last September (1907) I received an urgent call to attend a parturient in Calle C, district of Malate. It was a very serious case of retention of the placenta and the woman, who had been delivered of a live child at 2 o'clock in the morning, was, five hours later, at 7 o'clock in the morning when I was summoned to her bedside, in the last moments of a terrible hæmorrhage. Intervention at that time was useless and the life of

the patient could not be saved. The midwife was tranquil, believing that she had done her duty.

A little over a year ago I was called to the bedside of a woman in Calle Barbosa, district of Quiapo. This woman had been delivered of a live child at 10 o'clock in the evening. When I arrived at 2 o'clock the next morning, the placenta had not been expelled. A copious hæmorrhage had ensued, and while I was attempting to intervene, the patient began to collapse. The family subsequently informed me that a Chinese quack had acted as accoucher in the unfortunate delivery, but that he had disappeared upon my arrival.

Many other cases might be cited of parturients who have died of hæmorrhage, victims of the ignorance of the midwives. It is impossible to estimate the number of infants sacrificed by illegal practitioners who have folded their arms, content with a stupid temporizing in the frequent cases of *inertia uteri*, with the result that the child has died from prolonged detention in the vaginal canal, when a simple application of the forceps might have saved it. Among numerous cases of this kind I shall cite only one, which I witnessed in an interior street in the barrio of Santa Mesa at the beginning of the present year (1908). The woman was a multipara, her bladder had not been emptied for more than five hours, and the lack of uterine contractions had detained the child in the canal during the period of expulsion. When I sought to intervene with the forceps, the woman spontaneously gave birth to a beautiful and well-formed child which was born dead because of intra-uterine asphyxia, and which could have been delivered alive if the midwife had had intelligence enough to call a physician at the proper time.

A large number of women die every year in the Philippines as a result of puerpal infections, not only because the midwives are ignorant of the most rudimentary conceptions of asepsis and antisepsis, but also because the rooms in which the confinements take place are absolutely lacking in hygienic conditions. In the miserable huts in which the poorer classes live, there are at times neither clean water nor soap with which to wash the hands, the work of attending a birth becoming a veritable sacrifice for the physician who finds himself compelled to labor under such conditions, but even under these circumstances it is as a rule useless to advise the patient of the absolute necessity of being taken to a hospital where she can have proper attention, such a proposal being acceded to by herself and her family only with the greatest reluctance.

The aversion which Filipino women have to entering hospitals is due principally to their great attachment to their homes, together with an excessive love, sometimes ridiculous and mistaken, for their families and relatives from whom they are seldom separated. They cling to this notion even at the cost of their lives. It is also certain that the

improbable tales concerning the hospitals circulated by ignorant midwives and meddlesome practitioners of the neighborhood, add not a little to the fomenting of this spirit of aversion. For example, it is said among a certain class of people that all the parturients who go to the hospital are operated upon there, sometimes the abdomen being opened to extract the child. It is also told that parturients are placed in beds in proximity to those of dying patients and that they are compelled to witness the sadness and horrors of death and also that at midnight they hear the moans and laments of those seriously ill. These systematic detractors of hospital service also take pains to spread abroad a revised and exaggerated account of the bad administration of hospitals, especially with reference to alimentation and care.

As a result of all this, months and months pass during which the beds arranged for parturition in the hospitals are unoccupied by Filipino women. This is not only injurious to the parturients and their newborn infants, many of whom die without medical attendance, but is detrimental also to the students in obstetrics who do not and can not have an opportunity for practical study, being thus limited to being mere theorists in this branch of medicine so essentially practical and experiential.

However, it has been possible to correct this difficulty to a certain extent, by the appointment of two externs in obstetrics, charged with gratuitously attending poor women in Manila during childbirth at their homes, the students taking advantage of these opportunities for their clinical instruction. Without such recourse, which we owe to the initiative of the Philippine Medical School, students would finish their entire course without any practical experience in obstetrics. The difference between the number of births witnessed by students in the hospital and those which took place in private houses is instructive. In St. Paul's Hospital the students saw only two births during the semester from July 1 to December 31 of the year 1907, whereas during the same period they attended 76 births in private houses, classified as follows:

Normal births	47
Application of forceps	9
Versions, shoulder presentation	6
Placenta prævia	5
Breech presentation	4
Post-partum hæmorrhage	2
Puerpal eclampsia	2
Retention of the placenta	1
Total	76

Perineorrhaphia was performed in several instances.

The 76 births witnessed by students in the various districts of the city is a much greater number than the two which they saw in St. Paul's

Hospital; but, taking them all together, what do 76 births, during a period of six months, signify for a city the size of Manila? This insignificant total is an eloquent proof of the exceedingly small moral influence the physician exerts on Filipino women of the lower classes and, on the other hand, demonstrates the palpable preponderance of illegal practitioners and ignorant midwives, monopolizers of almost all the parturitions among the poor and ignorant women of the city. It is even true that the two externs in obstetrics have been compelled to avail themselves of the influence of illegal practitioners, by means of a wise policy of attraction, in order to attend confinements.

To eliminate the illegal practitioner is, for the moment, a problem difficult of solution, for of what advantage would an energetic campaign against them at present be when we lack competent midwives? If the externs in obstetrics are reduced to attending maternity cases in miserable, small habitations, it will be possible for them to take along not more than two or three students to each case, and for this purpose the students would have to confine themselves strictly to fortnightly turns. Lacking the most necessary things, at times even clean water, soap and towels for washing their hands, the students have been compelled by circumstances to perform operations in filthy beds in unsanitary places and in an unhygienic atmosphere, the lying-in room serving at the same time as bed-chamber, kitchen and even workshop to an entire family!

In view of the data cited, it is not difficult to foresee that the obstetrical pavilion of the future hospital will be a failure unless energetic measures are resorted to and certain reforms adopted to bring the poor and ignorant women of this city there for confinement. One of the first steps, after the construction of this pavilion, should be the enactment of a law establishing a school of midwifery for the entire Archipelago, and, as a measure of attraction to induce the ignorant women of the city to go there for confinement, I propose that some of the most popular and best-known illegal practitioners from the several suburbs of Manila be admitted as students in that school. This suggestion, however strange it may seem, will give positive results in the field of practice, because eight or ten of these practitioners, matriculated as students and enabled to secure the degree of qualified midwife, would serve as excellent propagandists for attracting parturients to the obstetrical ward, much better than all theoretical means of doubtful success. In a word, the great prestige which some of these illegal practitioners now enjoy among the lower classes of Manila should be used, through a wise policy of attraction, to further the beneficent ends of scientific propaganda.

The defective midwifery service now existing in Manila should be organized by regulations rendering efficacious the gratuitous treatment of poor parturients. Nothing would serve this purpose better than to place the midwives under the immediate control of the externs in obstetrics, whose duty it would be to approve the birth certificates issued

and to watch the obstetrical operations in their respective districts. The existing provisions regarding birth certificates should be strictly enforced in each instance, and for this purpose the curates and pastors of the churches in this capital should be required to comply with their obligation not to administer baptism to any child without the previous presentation of that document, in the same manner as death certificates are required in the case of funerals. If this should require an increase in the number of municipal midwives in Manila, then, for the sake of the poor, let the number be increased and, incidentally, the miserable pittance of 20 pesos per month which is now their stipend.

As soon as the obstetrical pavilion has been constructed, a circular should be sent to all the practicing physicians in this capital, courteously inviting them to bring to the clinic such maternity cases as they choose, leaving them complete liberty of action for intervention should they so require. In order to remove common prejudices and traditions, admission into the clinic should be permitted during the first year of its establishment, not alone to the parturient, but also to two or three of her nearest relatives, so that they may spread a knowledge of the undoubted advantages of confinement in the maternity ward as compared with those of private dwellings.

When the necessity for the establishment of a medical school for this Archipelago was discussed before the Philippine Commission, the theory was advanced that the project would result in a heavy burden on the Insular budget, it being more feasible and economical to send young Filipinos to America as Government students to study medicine. In making this objection, it was not taken into consideration that instead of an educational labor for the benefit of certain elements, a social labor within the Philippine Archipelago would be undertaken, involving the exceedingly important problem of infant mortality and of the practice in the Philippine Islands of obstetrics in accordance with modern methods and standards.

## ILLUSTRATIONS.

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PLATES I-III. Conditions surrounding obstetrical practice in Manila among the poorer classes.



PLATE I.





PLATE II.



PLATE III.

## EDITORIAL.

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### DISCUSSIONS ON THE PAPERS OF DR. GARRISON AND DR. GILMAN.

(The papers of Dr. Garrison and Dr. Gilman were considered conjointly.)

*Dr. Thomas W. Jackson, contract surgeon, United States Army, San Isidro, Nueva Ecija, P. I.*—I was much interested in Dr. Garrison's paper and I have been much impressed with the statistics that have been compiled. My observations have been comparatively limited, but I believe that the conditions which Dr. Garrison has outlined for Bilibid Prison prevail throughout the provinces. They are of common occurrence, and from three to five distinct infections have often been noted among Filipino Scouts by many Army men. Indeed it is exceptional to find a solitary variety of worms in a native Scout. Two or more varieties are usually in association.

The effect of multiple *ascaris* infection was not mentioned by Dr. Garrison. By this I mean the occurrence of a large number of worms in the same individual and when the discussion closes I would like him to state the maximum number which has been observed in a single individual. I have already found in a child forty-eight round worms. The child was also infested with hookworms and amœbæ.

*Dr. N. M. Saleeby, superintendent of the University Hospital, Manila.*—One thing particularly interests me. A child in this city passed more than one hundred round worms, and I understand that a few days later it died. Does any one present know the death rate in these cases? I never investigated the subject, and I would be very glad if someone could enlighten me.

*Dr. W. E. Musgrave, Biological Laboratory, Bureau of Science, professor of clinical medicine, Philippine Medical School, President of the Association.*—It seems to me that these papers have brought out two prominent facts. In the first place, we find a large percentage of amœbic infection, both in diagnostic work (Garrison) and at autopsy (Gilman). This brings up the question of so much importance to the practicing physician of the means of diagnosis of amœbic infection of the bowel during the life of the patient. Dr. Gilman, in one hundred autopsies, found 54 cases with lesions of the colon, and it is altogether likely that at least 50 per cent of these were due to amœbæ. Dr. Garrison found

that 25 per cent of stools of all people examined contained amœbæ, which is a smaller percentage than the findings in the autopsy room. These figures would indicate infestation without infection to be very rare and would justify the conclusion that we are all too prone to require the presence of blood and mucus in the stools before we state that actual amœbic ulceration of the bowel is present.

*Dr. Henry S. Greenleaf, captain, United States Army.*—Has anyone who has been making a study of these parasites found evidences of guinea worms? When I was in Mindanao I found a Moro pulling something out of a sore and I asked the interpreter what he was doing. The man pointed to a little worm which had been pulled out of the sore and from his description I thought it might be a guinea worm. Is this parasite common among the natives? I have not looked up the subject.

*Dr. Musgrave.*—I have been looking for a guinea worm for nine years.

*Dr. Henry J. Nichols, first lieutenant, United States Army, Division Hospital, Manila.*—I have had an opportunity to examine 400 soldiers doing active field duty, and 200 of these had amœbæ present in their stools. Twenty-five per cent had symptoms of dysentery, and of this 25 per cent only about one-half showed the presence of active amœbæ.

*Dean C. Worcester, Secretary of the Interior, Philippine Commission, Manila.*—I have seen evidence on the subject of amœbic infection and it leads me to believe that if an amœba is not pathogenic at one time, it may become so at another. It has been suggested, in connection with some of our diseases in the Philippines, that dysentery is a white man's disease, but I believe it is true that a very large percentage of the native inhabitants have dysentery in a chronic form, and this is one of the causes tending toward their disinclination to labor. I was very much interested in Dr. Garrison's paper. The Secretary of War, while in Manila, called my attention to the very satisfactory results which had attended the efforts made on such a large scale in Porto Rico to rid the inhabitants of intestinal parasitic worms and suggested that similar work might be necessary here. It would appear from Dr. Garrison's paper that this is not probable. However, it sticks in my memory that I have read a report of Dr. Heiser on conditions in Bilibid Prison which showed infection with parasitic worms to be quite general among the inmates of that institution and that when systematic measures were taken to rid the convicts of these parasites, the death rate from other causes was immediately and materially reduced, showing that the patients had been so weakened by the presence of these parasites that they had fallen ready victims to other diseases. I should like to know whether Dr. Heiser can confirm this statement.

*Dr. Victor G. Heiser, Director of the Bureau of Health, Manila; professor of hygiene, Philippine Medical School.*—I believe the mortality incidence in the Philippines to be very intimately associated with the

intestinal parasites with which the inhabitants of these Islands are afflicted; we think we have statistics from Bilibid Prison that are fairly conclusive on this point. Several years ago the death rate was something over 200 per thousand. Ordinary sanitary methods were instituted—more air space was provided, drains were put in and other needful things done. These measures reduced the mortality to 60 per thousand, but this rate was still far in excess of what an institution of that character should have. We spent some six months examining into the various causes which might influence it. It finally occurred to us that intestinal parasites had some connection with the result, and I think the statistics will bear us out in our conclusions as they show that in each brigade of the 200 examined the mortality came down in a marked manner after the institution of remedial measures. When the prison was remodeled and the prisoners cured of their parasitic intestinal diseases, the mortality fell to 12 per thousand and has remained at that figure for the last six months. I think this result is one of the greatest triumphs of modern prophylactic medicine that has occurred in these Islands, and I believe that when the facts become known they will induce the laity to look with favor upon a campaign in these Islands for the elimination of intestinal parasites.

*Dr. Philip E. Garrison, assistant surgeon, United States Navy; medical zoölogist, Biological Laboratory, Bureau of Science; associate professor of medical zoölogy in the Philippine Medical School.*—We have reports of several hundred *Ascaris* removed from one individual. I think Dr. Musgrave recently recovered about 150 from a Filipino child at one treatment.

In our examinations a positive diagnosis of *Amæba* was made only when the moving organism was found in the stool.

A systematic clinical study of infected cases was not included in the purpose of my investigations and I am not prepared to offer any new information regarding the symptoms or pathology found in these infections. In considering the importance of intestinal worms as factors in either the death or sick rate of a community, the fact must be recognized that they play their most important rôle by predisposing to other diseases. Intestinal worms are rarely mentioned in mortality statistics, and it is exceedingly difficult to measure the relative participation in the death of the patient of the infection with intestinal worms which lowers the resistance of the host and the terminal infection which the mortality table recognizes as the immediate cause of death. The remarkable fall in the death rate at Bilibid following the institution of a systematic treatment for intestinal worms, of which Dr. Heiser has already spoken, is a striking contribution to our information on this very point, and if future records at the prison and the institution of similar measures in other communities should confirm the results which appear to have been accomplished there, even in a much less striking degree than the figures

Dr. Heiser has quoted would indicate, we shall be forced to the conclusion that intestinal worms, as predisposing factors to disease, are of greater importance from the viewpoint of the public health than the bacillary infections, such as tuberculosis, pneumonia, dysentery, etc., to which the weakened subject eventually succumbs.

With regard to the inquiry of the Secretary of War, of which Mr. Worcester has spoken, as to the need in the Philippines of a special, organized campaign against intestinal worms similar to that of the Anæmia Commission in Porto Rico, it would appear that in these Islands we have to deal with a condition different in several respects from that which confronted the health authorities in Porto Rico, the chief difference being the comparative rarity of severe manifestations of uncinariasis; and another, the greater population here. The results of the examinations at Bilibid indicate that not less than 5,000,000 of Filipinos are infested with intestinal worms and that these infections have a fairly even geographical distribution. To attempt to establish a helminthological clinic for these 5,000,000 of people would appear absolutely impracticable, even though we had ten times the means at hand that we now have, and took ten years for the campaign. Furthermore, such an effort would prove entirely unavailing without a practical revolution in certain sanitary conditions which prevail, as reinfection would constantly occur.

The one measure urgently demanded in the Philippines, in the light of our present knowledge of intestinal worms here, would appear to be the establishment of a system for the proper disposal of human excreta, thereby removing the almost exclusive channel by which these infections are spread. Until this is done, other measures would seem quite futile. We need only mention that in disposing of human excreta we eliminate one of the most dangerous channels for the dissemination of certain other prevailing diseases in addition to infections with intestinal worms. The methods to be employed and the question as to whether the work could be done better by a special commission or through existing organizations of the Government are subjects requiring special investigations.

## REVIEW.

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**Hygiene and Public Health.** By Louis C. Parkes, M. D., D. P. H., and Henry R. Kenwood, M. B., D. P. H. Third edition, with illustrations. Cloth. pp., xii+620. Price, \$3 net. Philadelphia: P. Blackiston's Son & Co., 1907.

The third edition of this work shows evidence of having been thoroughly revised and considerable new matter has been introduced, so that it easily maintains the reputation of being one of the most practical treatises upon hygiene that is published in the English language.

Much of the useless theoretical matter found in works of this kind has been omitted. The authors' practical experience in dealing with public health matters in this regard is shown to excellent advantage.

It would seem that in a new work of this kind the means now so commonly used in the United States of cleaning houses by the vacuum method should have been mentioned.

Many of the data published in this work are derived from conditions as they obtain in Great Britain, and more particularly is this true with regard to legislation, so that because of this much of the value of the work is lost to the American student.

V. G. H.  
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PRIZES OFFERED BY THE INTERNATIONAL CONGRESS ON  
TUBERCULOSIS, TO BE HELD IN WASHINGTON,  
D. C., IN SEPTEMBER, 1908.

The central committee of the International Congress on Tuberculosis has announced the offer of the following prizes:

I. A prize of \$1,000 is offered for the best evidence of effective work in the prevention or relief of tuberculosis by any voluntary association since the last International Congress in 1905. In addition to the prize of \$1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

Evidence is to include all forms of printed matter, educational leaflets, etc.; report showing increase of membership, organization, classes reached—such as labor unions, schools, churches, etc.; lectures given; influence in stimulating local boards of health, schools, dispensaries, hospitals for the care of tuberculosis; newspaper clippings of meetings held; methods of raising money; method of keeping accounts.

Each competitor must present a brief or report in printed form. No formal announcement of intention to compete is required.

II. A prize of \$1,000 is offered for the best exhibit of an existing sanatorium for the treatment of curable cases of tuberculosis among the working classes. In addition to the prize of \$1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management, and results obtained. Each competitor must present a brief or report in printed form.

III. A prize of \$1,000 is offered for the best exhibit of a furnished house, for a family or group of families of the working class, designed in the interest of the crusade against tuberculosis. In addition to the prize of \$1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award. This prize is designed to stimulate efforts toward securing a maximum of sunlight, ventilation, proper heating, and general sanitary arrangement for an inexpensive home. A model of house and furnishing is required. Each competitor must present a brief with drawings, specifications, estimates, etc., with an explanation of points of special excellence. Entry may be made under competitor's own name.

IV. A prize of \$1,000 is offered for the best exhibit of a dispensary or kindred institution for the treatment of the tuberculous poor. In



addition to the prize of \$1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management, and results obtained. Each competitor must present a brief or report in printed form.

V. A prize of \$1,000 is offered for the best exhibit of a hospital for the treatment of advanced pulmonary tuberculosis. In addition to the prize of \$1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management, and results obtained. Each competitor must present a brief or report in printed form.

VI. The Hodgkins fund prize of \$1,500 is offered by the Smithsonian Institution for the best treatise that may be submitted on "The Relation of Atmospheric Air to Tuberculosis."

The detailed definition of this prize may be obtained from the secretary-general of the International Congress or Secretary of Smithsonian Institution, Chas. D. Walcott.

VII. Prizes for educational leaflets.

A prize of \$100 is offered for the best educational leaflet submitted in each of the seven classes defined below. In addition to the prize of \$100, a gold medal and two silver medals will be awarded in each class. Each prize and medal will be accompanied by a diploma or certificate of award.

Competitors must be entered under assumed names.

A. For adults generally (not to exceed 1,000 words).

B. For teachers (not to exceed 2,000 words).

C. For mothers (not to exceed 1,000 words).

D. For indoor workers (not to exceed 1,000 words).

E. For dairy farmers (not to exceed 1,000 words).

F. For school children in grammar school grades (not to exceed 500 words).

In classes A, B, C, D, E, and F, brevity of statement without sacrifice of clearness will be of weight in awarding. All leaflets entered must be printed in the form they are designed to take.

G. Pictorial booklet for school children in primary grades and for the nursery.

Class G is designed to produce an artistic picture-book for children, extolling the value of fresh air, sunlight, cleanliness; etc., and showing contrasting conditions. "Slovenly Peter" has been suggested as a possible type. Entry may be made in the form of original designs without printing.

VIII. A gold medal and two silver medals are offered for the best exhibits sent in by any States of the United States, illustrating effective

organization for the restriction of tuberculosis. Each medal will be accompanied by a diploma or certificate of award.

IX. A gold medal and two silver medals are offered for the best exhibits sent in by any State or country (the United States excluded), illustrating effective organization for the restriction of tuberculosis. Each medal will be accompanied by a diploma or certificate of award.

X. A gold medal and two silver medals are offered for each of the following exhibits; each medal will be accompanied by a diploma or certificate of award; wherever possible each competitor is required to file a brief or printed report:

A. For the best contribution to the pathological exhibit.

B. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any State of the United States. Brief required.

C. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any State or country (the United States excluded). Brief required.

D. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any municipality in the world. Brief required.

E. For the society engaged in the crusade against tuberculosis having the largest membership in relation to population. Brief required.

F. For the plans which have been proven best for raising money for the crusade against tuberculosis. Brief required.

G. For the best exhibit of a passenger railway car in the interest of the crusade against tuberculosis. Brief required.

H. For the best plans for employment for arrested cases of tuberculosis. Brief required.

XI. Prizes of two gold medals and three silver medals will be awarded for the best exhibit of a workshop or factory in the interest of the crusade against tuberculosis. These medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management, and results obtained. Each competitor must present a brief or report in printed form.

The following constitute the committee on prizes: Dr. Charles J. Hatfield, Philadelphia (chairman); Dr. Thomas G. Ashton, Philadelphia (secretary); Dr. Edward R. Baldwin, Saranac Lake; Dr. Sherman G. Bonney, Denver; Dr. John L. Dawson, Charleston, S. C.; Dr. H. B. Favill, Chicago; Dr. John B. Hawes, 2d, Boston; Dr. H. D. Holton, Brattleboro; Dr. E. C. Levy, Richmond, Va.; Dr. Charles L. Minor, Asheville, N. C.; Dr. Estes Nichols, Augusta, Me.; Dr. M. J. Rosenau, Washington; Dr. J. Madison Taylor, Philadelphia; Dr. William S. Thayer, Baltimore; Dr. Louis M. Warfield, St. Louis.

**PREVIOUS PUBLICATIONS OF THE BUREAU OF GOVERNMENT  
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(Concluded from second page of cover.)

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No. 33, 1905, *Biological Laboratory*.—Further Observations on Fibrin Thrombosis in the Glomerular and in Other Renal Vessels in Bubonic Plague. By Maximilian Herzog, M. D.  
No. 34, 1905.—I. Birds from Mindoro and Small Adjacent Islands. II. Notes on Three Rare Luzon Birds. By Richard C. McGregor.  
No. 35, 1905.—I. New or Noteworthy Philippine Plants, IV. II. Notes on Cuming's Philippine Plants in the Herbarium of the Bureau of Government Laboratories. III. Hackel, "Notes on Philippine Grasses." IV. Ridley, "Scitiminaceae Philippinenses." V. Clarke, "Philippine Acanthaceae." By Elmer D. Merrill, Botanist.  
No. 36, 1905.—A Hand-List of the Birds of the Philippine Islands. By Richard C. McGregor and Dean C. Worcester.

**LIST OF PREVIOUS PUBLICATIONS OF THE MINING BUREAU (NOW DIVISION OF  
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1890.—Memoria descriptiva de los manantiales minero-medicinales de la Isla de Luzon, estudiados por la comisión compuesta de los Señores D. José Centeno, Ingeniero de Minas y Vocal Presidente, D. Anacleto del Rosario y Sales, Vocal Farmacéutico, y D. José de Vera y Gómez, Vocal Médico.  
1893.—Estudio descriptivo de algunos manantiales minerales de Filipinas ejecutado por la comisión formada por D. Enrique Abella y Casariego, Inspector General de Minas D. José de Vera y Gómez, Médico, y D. Anacleto del Rosario y Sales, Farmacéutico; precedido de un prólogo escrito por el Excmo. Sr. D. Angel de Avila, Director General de Administración Civil.  
1893.—Terremotos experimentados en la Isla de Luzón durante los meses de Marzo y Abril de 1892, especialmente desastrosos en Pangasinán, Unión y Benguet. Estudio ejecutado por D. Enrique Abella y Casariego, Inspector General de Minas del Archipiélago.  
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1905, *Bulletin No. 5*.—The Coal Deposits of Batan Island. Warren D. Smith, B. S. M. A., Geologist.

**DIVISION OF MINES.**

- 1908.—The Mineral Resources of the Philippine Islands, with a Statement of the Production of Commercial Mineral Products during the year 1907, issued by Warren D. Smith, Chief of the Division of Mines.

**LIST OF PREVIOUS PUBLICATIONS OF THE ETHNOLOGICAL SURVEY (NOW DIVI-  
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